

GUICS: Graphic User Interface for Crop Simulation with Windows 95

Version 1.7

User's Manual

by

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This manual documents GUICS version 1.7 as of March 25, 1998.
GUICS is a WindowsTM interface for crop simulators. It runs under Windows 95.

GUICS can support many crop models simultaneously.

GUICS is the first crop simulator interface that has been designed with the direct help and advice of farmers and consultants.

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GUICS is a direct continuation of the work on WINGLY, the Windows interface for the soybean simulator GLYCIM that was carried out by Antony Trent and Paul Amonson.

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GUICS is a tool to help run crop simulators. No warranty is given on the reliability of a particular simulator run by GUICS.

Please send all questions about, comments on, or problems with GUICS to Yakov Pachepsky at (301)504-7468, fax (301)504-5823, E-mail ypachepsky@asrr.arsusda.gov.

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The Concept

GUICS is a Windows 95 interface to run crop simulators. There are many crop simulators available nowadays. Despite all the differences between them, they have common features that have enabled us to develop this interface.

The hierarchy of information units in GUICS is based on the fact that one run of any crop simulator makes predictions for a particular combination of weather, soil, crop cultivar, and farm operations. Data on weather, on soil, etc., are referred to as datasets; datasets are organized by data category according to the type of data. A complete set of datasets for a crop simulator are referred to as a scenario. Several related scenarios may be combined into a group that is called a project. Each scenario must belong to a project.

GUICS runs a crop simulator after arranging the input data for one or for several scenarios according to the user's request. GUICS displays the results in graphic, tabular, and text forms. If several scenarios are of interest, the tables and graphs will display results of all scenarios simultaneously to facilitate a comparison of results. Several ways to visualize the results are available. A toolbar is included to simplify viewing results.

Copying, deleting, and editing functions are available at all levels of the 'project-scenario-dataset' hierarchy. Several additional functions are specific to a particular level of the hierarchy. At the scenario level, a user can vary the scenario, that is generate a set of scenarios differing by one dataset only.

Calling a weather station to update the current weather dataset is possible.

Each information unit (a project, a scenario, a dataset) has a name, and may have an icon and a memo. An icon is meant to simplify recognizing a unit or to symbolize essential features of a unit. A memo is a text description of a unit.

The interface has a set of wizards to guide a user through all stages of project development, scenario assembly, viewing results, and editing datasets. The on-line help is included.

GUICS interacts with a crop simulator as with a stand-alone code. Scripts have to be written to plug a simulator into GUICS. The scripts describe the structure of input and output datasets specific to a particular simulator. Authors may want to modify the output of their simulators to take advantage of the capabilities of GUICS in viewing results.

There is no standard in datasets for crop simulations. GUICS allows different simulators to have different datasets for the same data category, for example different soil files for the same field.

GUICS has a fully object-oriented design and implementation. It is open to enhancements, e.g., using maps, displaying animation, using data bases to store datasets.

About This Manual

The manual is divided into eight chapters. Chapter One shows how to set up the program. Chapter Two gives a detailed look at operations with projects and scenarios. Chapter Three discusses viewing results of simulations. Chapter Four covers operations with datasets. Chapter Five shows how to obtain data from a weather station. Chapter Six explains how to plug a crop simulator into GUICS. Chapter Seven shows how to use graphics which is specific to a particular crop simulator. Chapter Eight contains instructions on removing GUICS from your computer. Appendix A describes graphic user interface terminology used in the manual. Appendix B contains the standard code needed to plug a simulator in GUICS. Appendix C shows how the file system is arranged. Appendix D explains how to convert WINGLY files into GUICS files.

GUICS comes with the example of a soybean crop simulator GLYCIM (Acock and Trent, 1991). GLYCIM is a research model that has been tested and used on farms for 6 years. Screen examples necessarily reflect the input and output specific to GLYCIM.



Chapter One: *Installing GUICS*

1.1 *Installing GUICS*

Note these system requirements...

GUICS requires 486 or higher computer with a math coprocessor, 16 MB of RAM, and approximately 4MB of available hard disk space. You need Windows 95 to run GUICS. You need a modem to download weather data using GUICS.


Follow these steps to install the program...

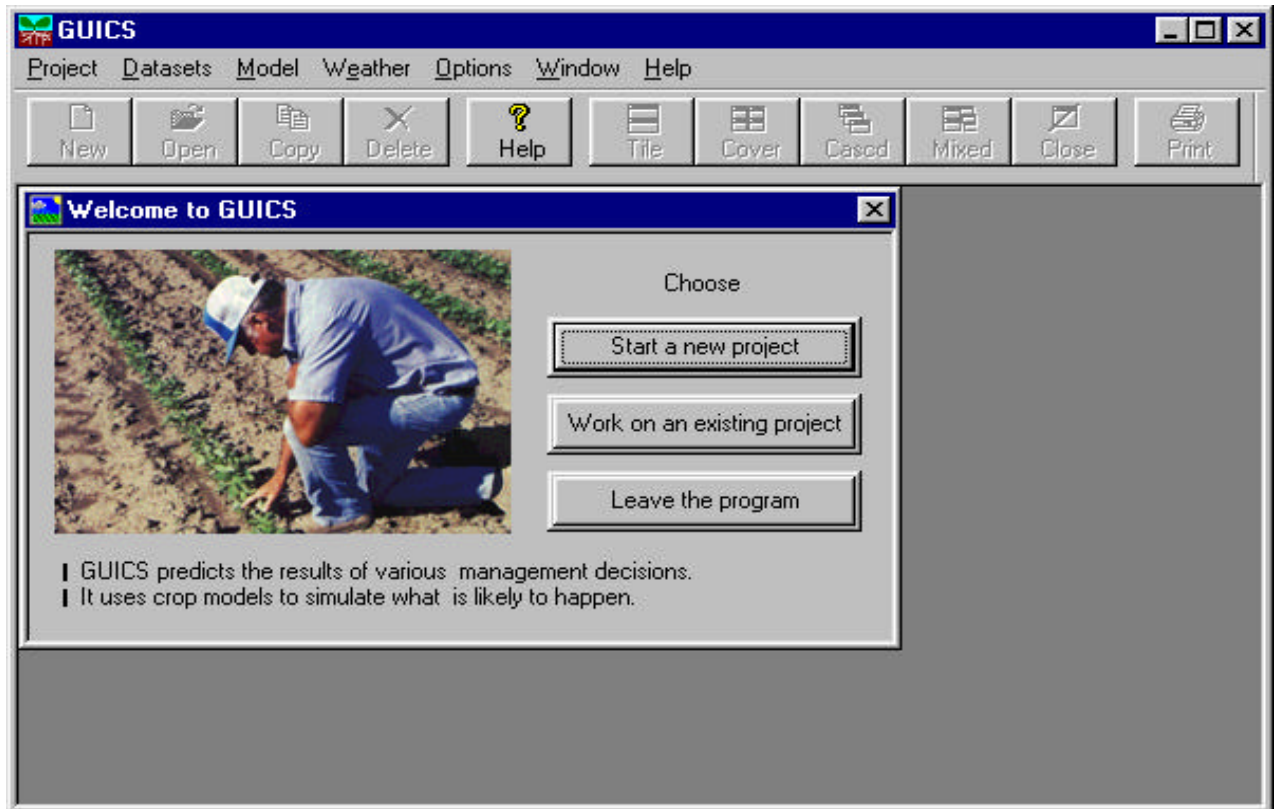
1. Exit all Windows programs that you have been running.
2. Insert the GUICS Disk 1 into drive A or B of your computer.
3. Doubleclick the icon group 'My Computer' 
4. Doubleclick the icon of the drive where the diskette is inserted.
5. Doubleclick the icon 'Setup.exe' 
6. Follow the instructions of the InstallShield program. You may always use the default destination directory C:\GUICS and the default program group 'Accessories'. You may click the 'Cancel' button to quit Setup any time during installation. Click the 'Next' button to continue installation.

You will be informed when the installation is completed.

Now you are ready to begin using GUICS.

Chapter Two: *Working with Projects and Scenarios*

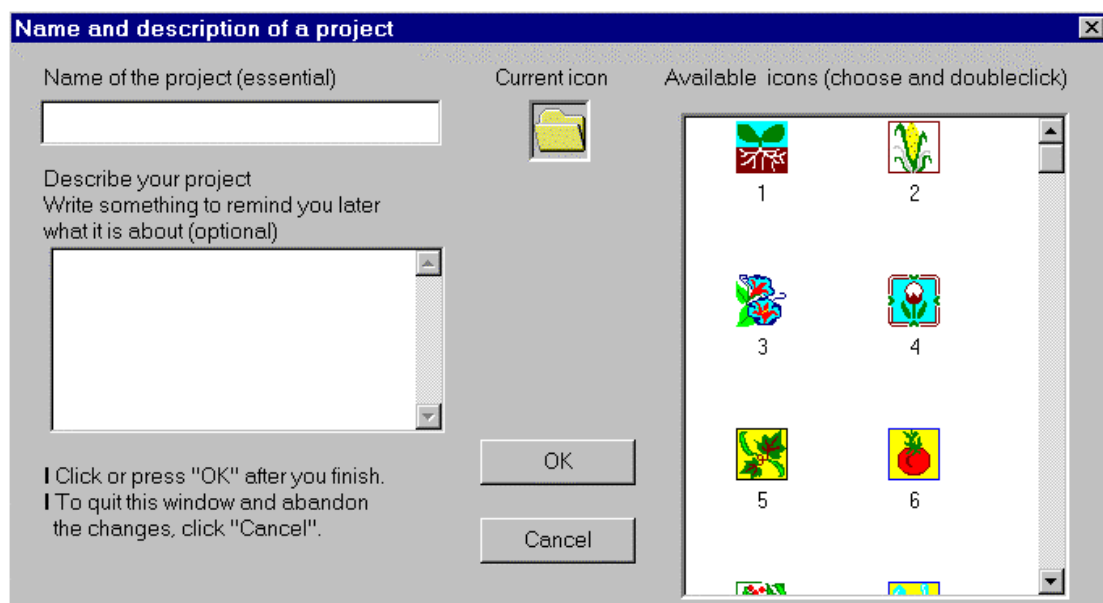
Once you have installed GUICS, doubleclick the GUICS icon . The 'GUICS' window and 'Welcome to GUICS' window appear, and you have the choices of creating a new project or working with an existing project.



2.1 Creating a New Project

Creating a new project involves giving a name to the project, writing a memo about it, and selecting an icon to represent it.

Click the 'Start a new project' button in the 'Welcome to GUICS' window, or select Project|New from the menu bar. The window 'Name and description of a project' appears.

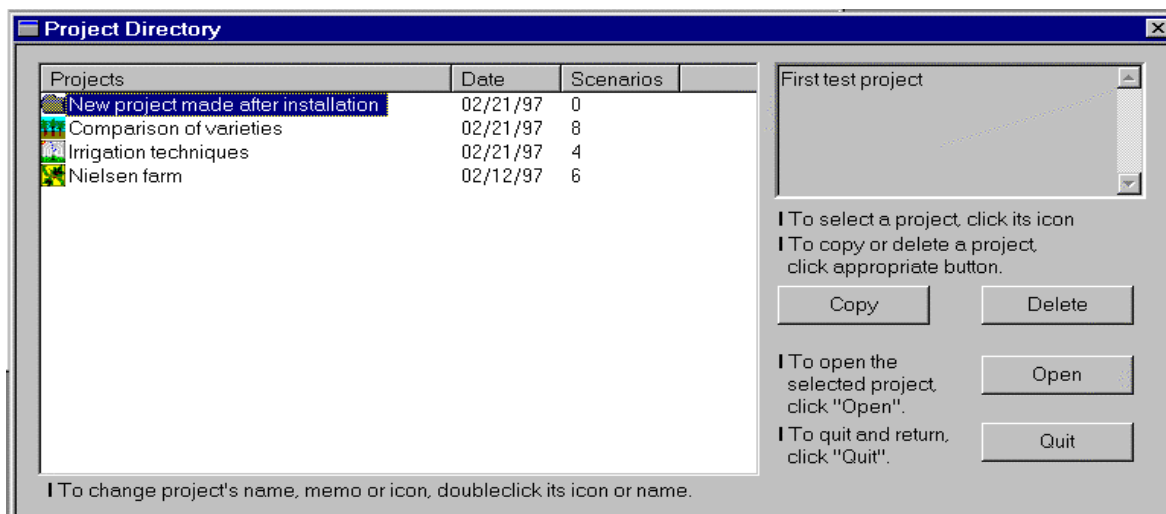


Type the name of the project. Any combination of characters can be used. Writing a memo is recommended. Write something to remind you later what the project is about.

To select an icon, doubleclick it. Selection of an icon is optional. Some people have found it useful.

Click the 'Cancel' button if you have changed your mind and do not want the new project to be created.

Click 'OK' when finished with the name, the memo, and the icon. You will see the 'Project directory' window that displays the list of projects including the one you have just created.



The next step after creating a new project is usually the creation of a new scenario (Section 2.5).

2.2 Opening an Existing Project

Click the 'Work with an existing project' button in the 'Welcome to GUICS' window, or select Project|Open in the menu bar. You will see the 'Project directory' window. Click the name of the project you want to work with. Click the 'Open' button in this window or click the toolbar button

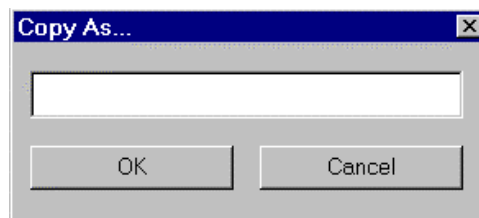


. You will see a window of your project with the list of scenarios.

2.3 Copying a Project

Copying a project means creating a new project that has the same scenarios as the original one, but has a different name and may have a different memo and a different icon.

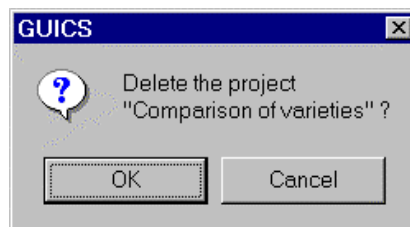
Select the project to copy in the 'Project directory' window by clicking on its name or its icon. Then click the 'Copy' button. The 'Copy As...' window will be displayed.



Type a name for the duplicate that you want to create. Click 'OK' to return to the 'Project directory' window. The copy will be present in the list of projects. Edit the duplicate if a change in the memo and/or icon is needed.

2.4 Deleting a Project

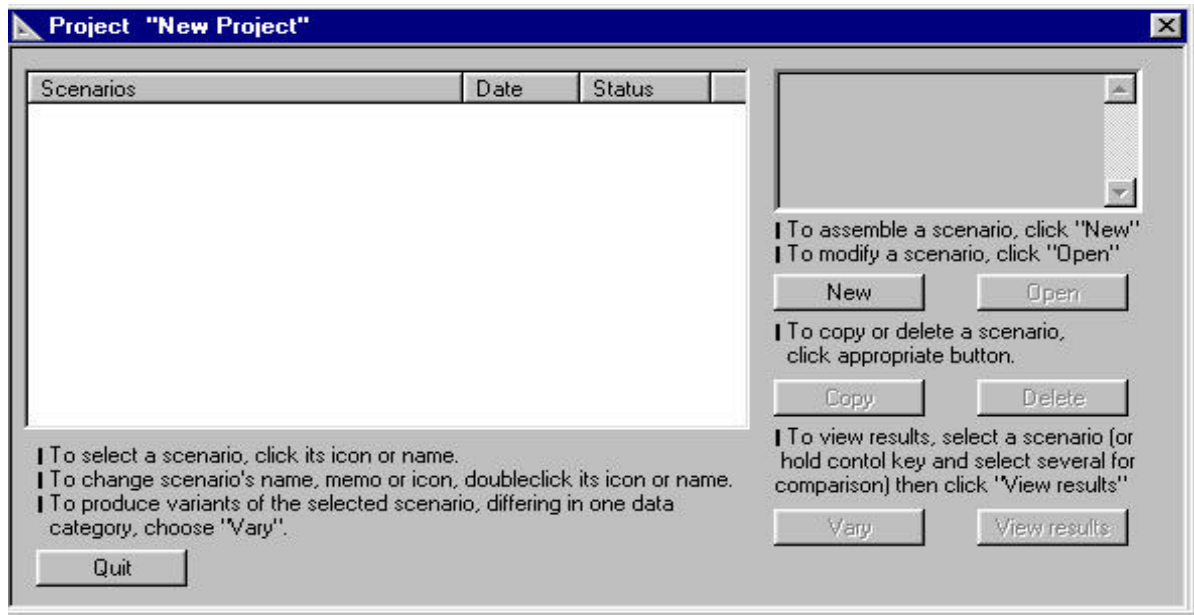
To delete a project, select it in the dialog box of the 'Project directory' window by clicking on its name or icon, then click 'Delete'. The following warning will be displayed.



The name of the selected project will be shown in this window. Click 'OK' and the project will be deleted. Click the 'Cancel' button to prevent the deletion.

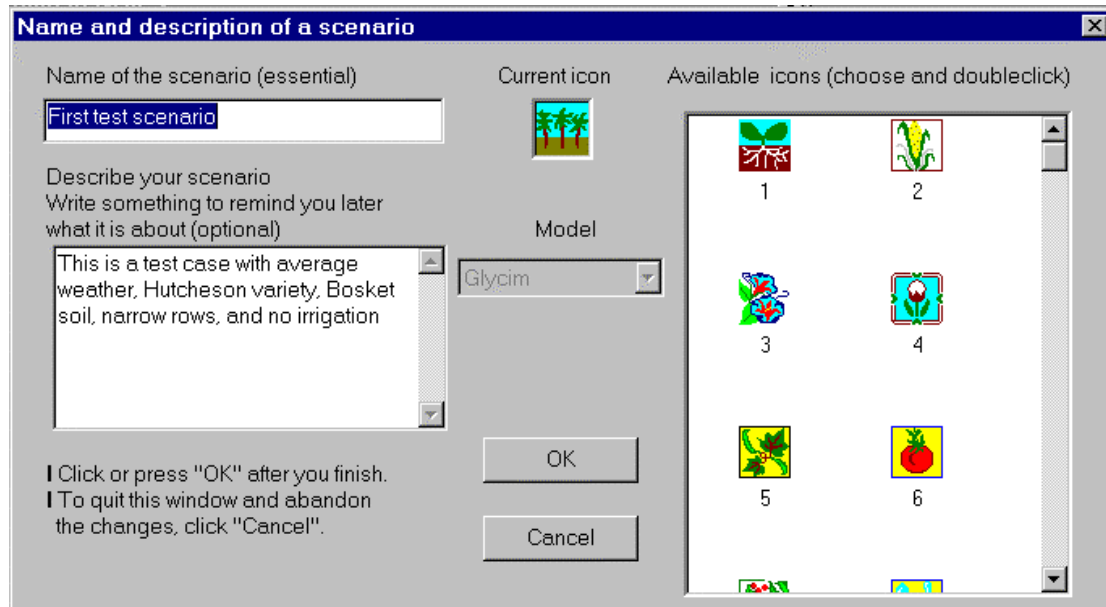
2.5 Creating a New Scenario



Creating a new scenario means giving a name to the scenario, writing a memo about it, selecting the scenario icon, and selecting the full set of scenario datasets.



You may create a scenario only after you have selected an existing or a new project. To select a project, click the name or the icon of the project in the 'Project directory' window and open the project with the button 'Open', or use Project|Open in the menu bar. A window appears that has the name of the project in the title bar:

The window with the project name in the title bar shows a list of scenarios that have already been assembled, the date of assembling and the status of each scenario. The status of a scenario shows whether a scenario has already been computed and is ready for an immediate display of results, or that a scenario has only been assembled and still needs to be computed. The list of scenarios will be empty for a new project. Click button 'New' or use 'New' from the toolbar. The 'Name and description of a scenario' window will be displayed.



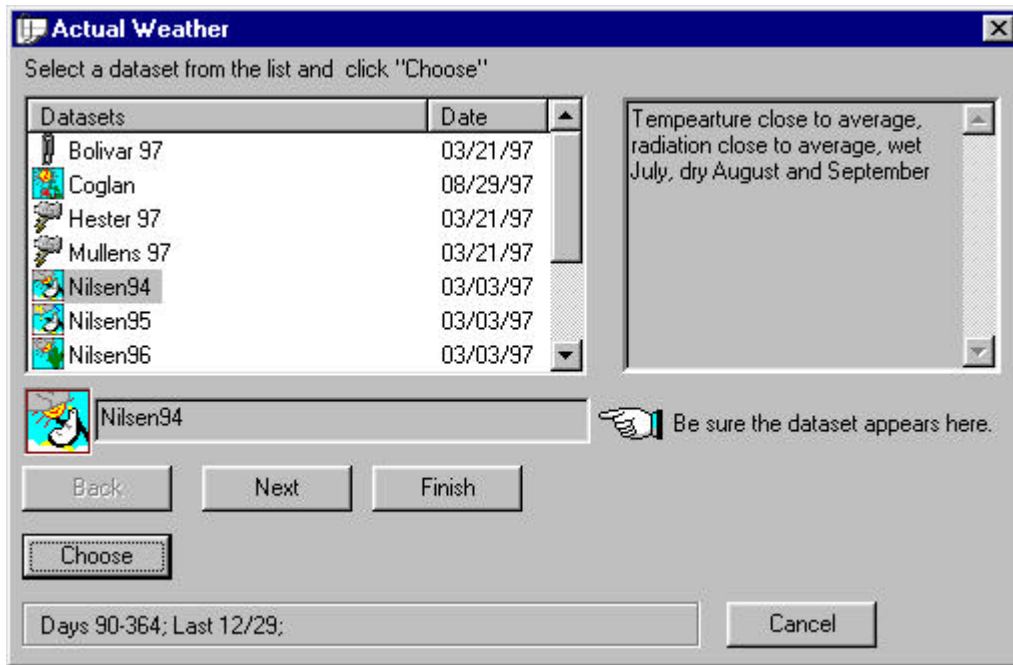
You have to select a model to use in simulations with this scenario. A combo box with the control button  contains the list of available models. You can see the whole list when you click the control button . Click the name of the model that you intend to use in the scenario. Then type the name of the scenario.


Writing a memo is recommended. Write something to remind you later what the scenario is about. Do not make the name of the scenario too long, use the memo to write details about the scenario.

To select an icon, doubleclick it. Selection of an icon is optional.

Click the 'OK' button to start assembling the scenario. Dialog boxes with lists of available datasets will be shown sequentially until datasets of all categories that are needed have been selected.

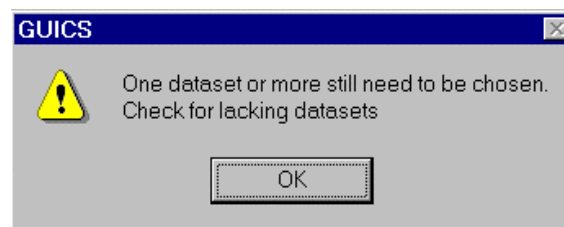
In the GLYCIM example, the 'Actual Weather' window will be displayed first.



Point to the name or the icon of a dataset to include it in the scenario and click the 'Choose' button. Be sure that the name and the icon of the selected dataset appear in the box below the list of datasets (where the finger  points). Then click the 'Next' button to see the list of datasets of the next category. The button 'Next' will be grayed out to show when you are on the last step of assembling a scenario. By clicking the 'Finish' button, you end the assembling of a new scenario.

You may browse back and forth among the lists of datasets using the 'Back' and 'Next' buttons.

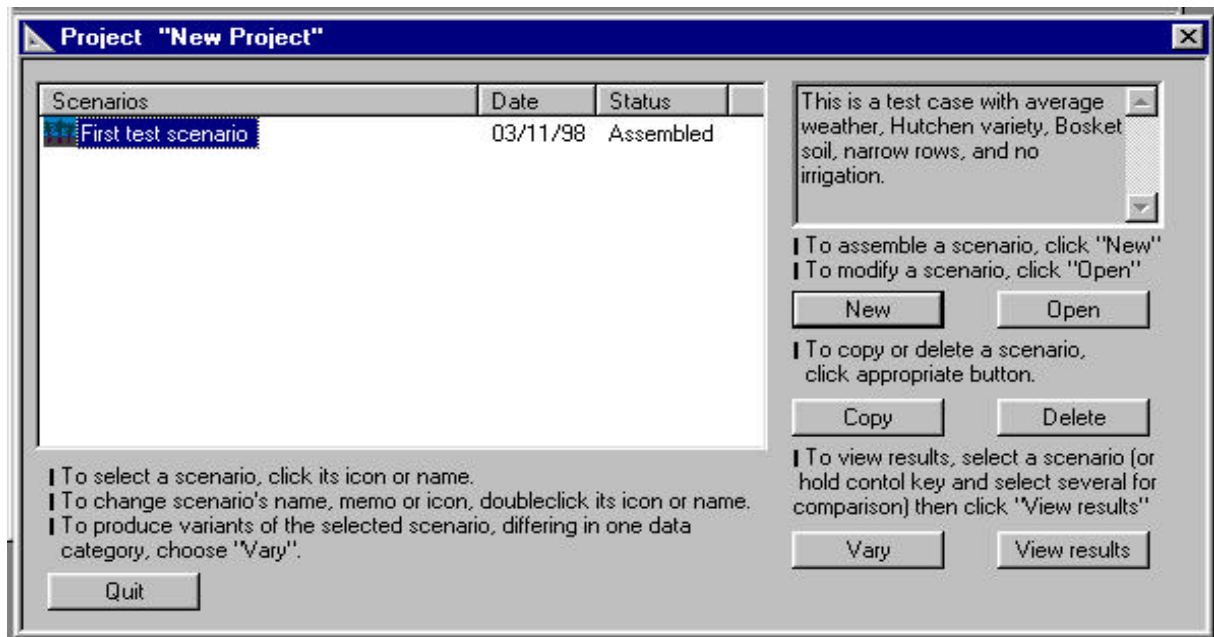
You will not be allowed to finish assembling the scenario if you have forgotten to select one or more datasets. The message will look as shown at next page.



Use the 'Back' button to find the category of data you did not include in the scenario.

You may cancel the assembling of a new scenario any time by pressing 'Cancel'. In this case, all information about the new scenario will be lost.

The newly created scenario will be given the status 'Assembled' in the project window. The response of the model to this scenario will be computed when results are requested (see Chapter 3 'Viewing results').



2.6 Editing an Existing Scenario

Editing an existing scenario means making changes in the name of the scenario, in its memo, in the scenario icon, or in some of its datasets. You cannot change the model in an existing scenario.

You may edit a scenario after you have opened the project to which this scenario belongs.

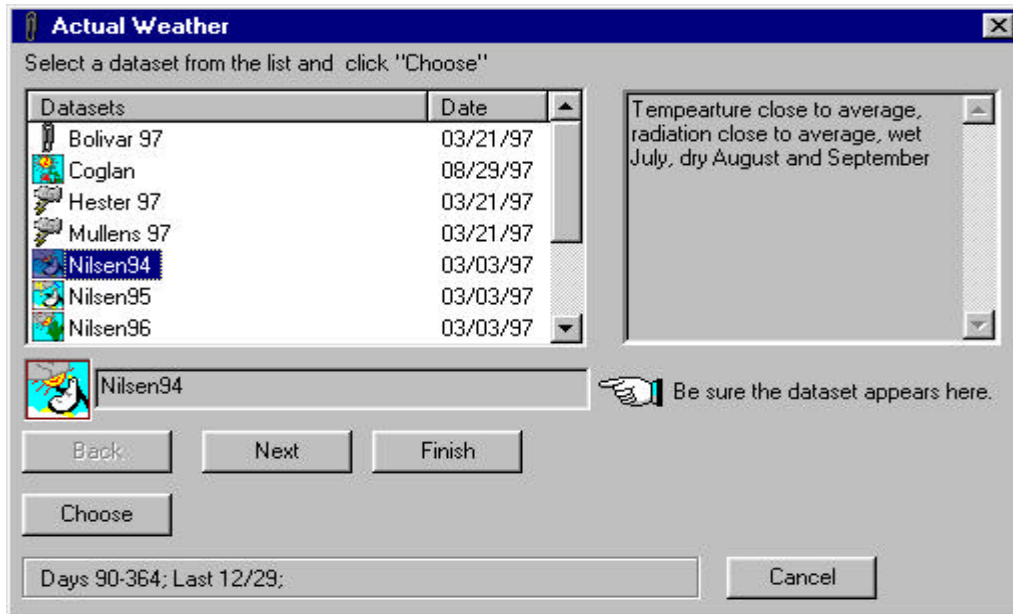
The window with the name of the project in the title bar shows a list of scenarios. Select the scenario to edit by clicking its icon or name. Click the 'Open' button in the window or use 'Open' from the toolbar. The 'Name and description of a scenario' window will be displayed.

You may now change the name of the scenario.


You may edit the memo and change the icon while you have this window displayed. To select an icon, doubleclick it.

Click 'OK' to reach the first data category. The list of datasets will be displayed.

In the GLYCIM example, the ‘Actual Weather’ window will be displayed first.



Click the ‘Next’ button repeatedly to reach the data category with the dataset you want to replace.

Click the ‘Choose’ button the name or the icon of the dataset that you want to replace the existing data set in the scenario. Be sure that the name and the icon of the selected dataset appear in the box below the list of datasets (where the finger  points). Then click the ‘Next’ button to see the list of data in the next category. Click the ‘Finish’ button when you made all necessary changes.

You may browse back and forth among the lists of datasets by using the ‘Back’ and ‘Next’ buttons.

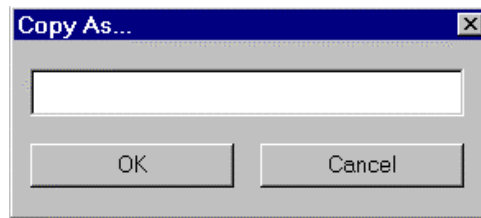
You may cancel the editing of the scenario any time by pressing ‘Cancel’. In this case, all information about the changes you made will be lost.

The edited scenario will be given the status ‘Assembled’ in the project window. The response of the model to that scenario will be computed when results are requested (see Chapter 3 ‘Viewing results’).

2.7 Copying a Scenario

Copying a scenario means creating a scenario that has the same datasets as the original one, but has a different name and may have a different memo and a different icon.

Select the original scenario in the window of the project by clicking on its name or its icon. Then click the 'Copy' button. The 'Copy As ...' window will be displayed.



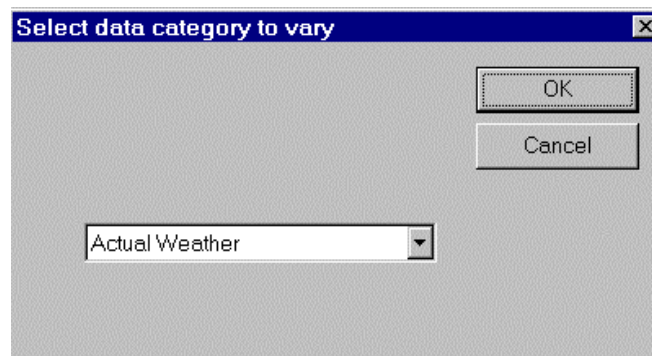
Type a name for the duplicate that you want to create. Click 'OK' to return to the window of the current project. The copy will be present in the scenario list. Edit the copy if a change in the memo and/or icon is needed.


Copies always have the status 'Assembled' and have to be re-computed to view results.

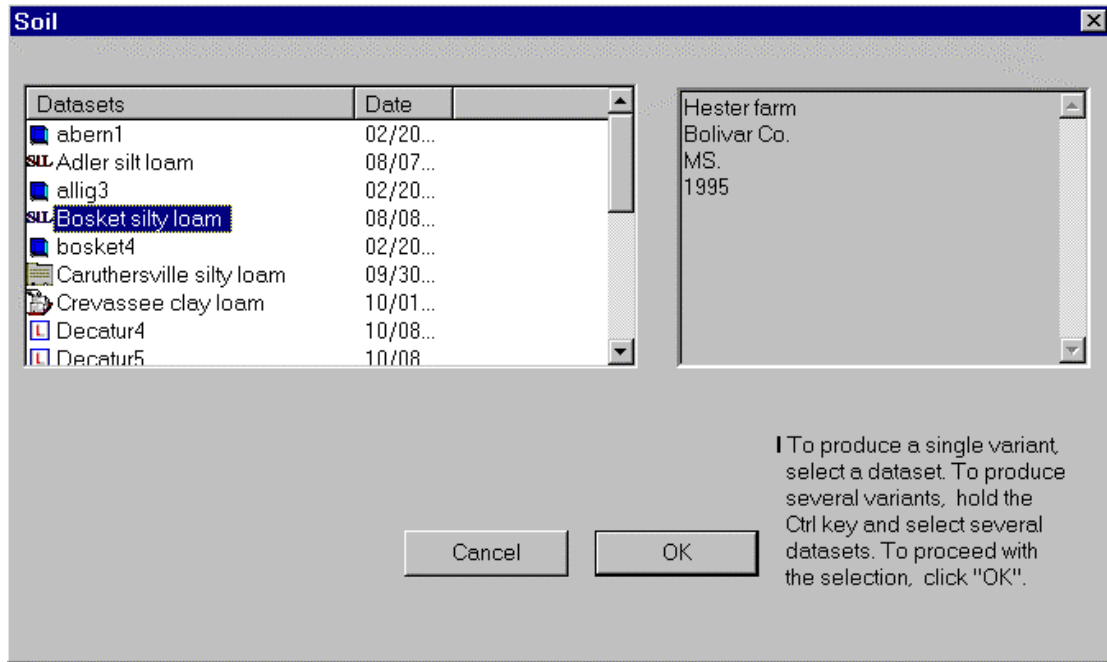
2.8 Varying a Scenario

Varying a scenario means creating one or more new scenarios which differ from the original one in datasets of only one category. An example is creating several scenarios that differ from the original one in weather data, while the datasets in all other categories (soil, cultivar, etc.) are the same in all variants.

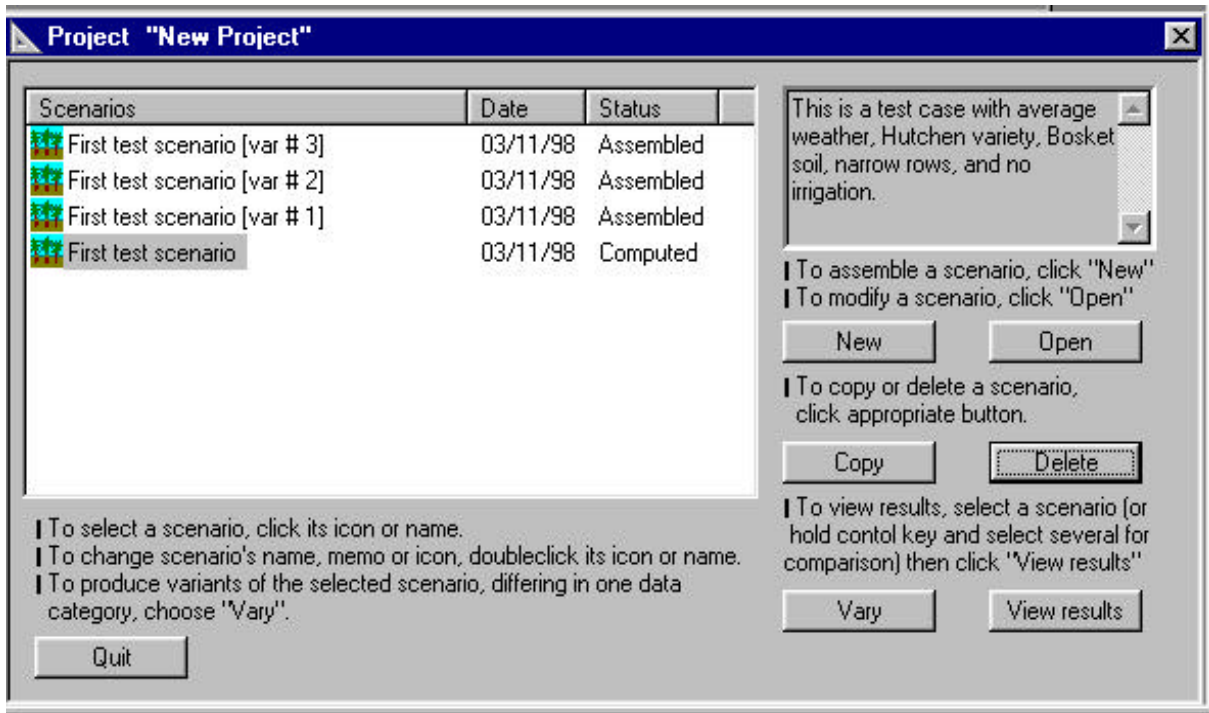
To vary a scenario, select it in the window of the project by clicking on its name or its icon. Then click the 'Vary' button. You will see a combo box with the list of data categories.



You can see the whole list when you click the control button . Click the name of the data type that you want to vary among scenarios, and click 'OK' to see available datasets on this category. The window with those dataset names will be displayed. The following example is for soil datasets



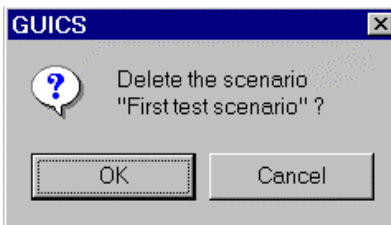
Select all datasets that you want in the variants of the original scenario. To make the selection, hold the CTRL key and click on the dataset names. Then click the 'OK' button. You will return to the current project window. All variants will be listed there. They will have a composite name including the name of the original scenario and the number of the variant in brackets. In the variants, the memo of the varied datasets will be appended to the memo of the original scenario.



All variants are given the status 'Assembled' and have to be re-computed to view the results.

2.9 Deleting a Scenario

To delete a scenario, select it in the project window by clicking on its name or icon. The following warning will be displayed.

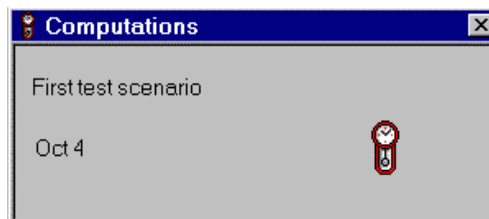


Click 'OK' and the scenario will be deleted. Click the 'Cancel' button to prevent the deletion.

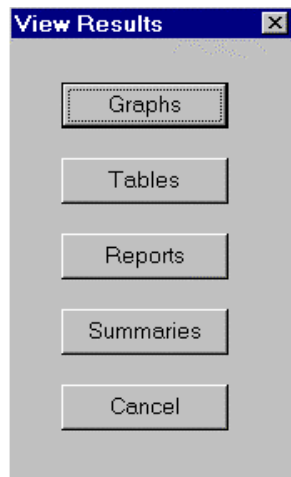
Chapter Three: *Viewing results*

3.1 *Obtaining results*

You can view the results of a single scenario or the results of several scenarios simultaneously. To select a single scenario, click its name or icon in the current project window. To select several scenarios, hold CTRL key and click the name or the icon of each of them. Then click the 'View results' button. If some of the selected scenarios have been assembled but have not been computed yet, the 'Computations' window will be displayed. It shows the name of the scenario which is currently being calculated. For the GLYCIM example, it also shows the date being simulated.



When all scenarios will be computed, the 'View Results' window will be displayed.



Graphs show the dependencies of essential variables on time.

Tables contain values of the most important variables.

Reports are full size detailed output files of the models.

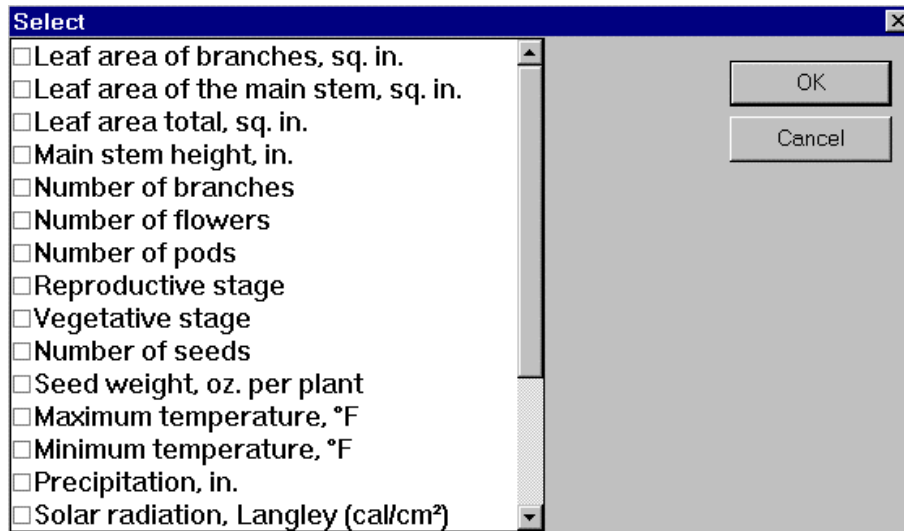
A summary is a small text file containing essential information about the results of a scenario.



Not all the models may have all four types of the result output. A disabled button in the 'View results' window shows the type of output which is not supported by the model used in the selected scenarios.

3.2 *Viewing graphs*

3.2.1 *Selecting variables to graph*

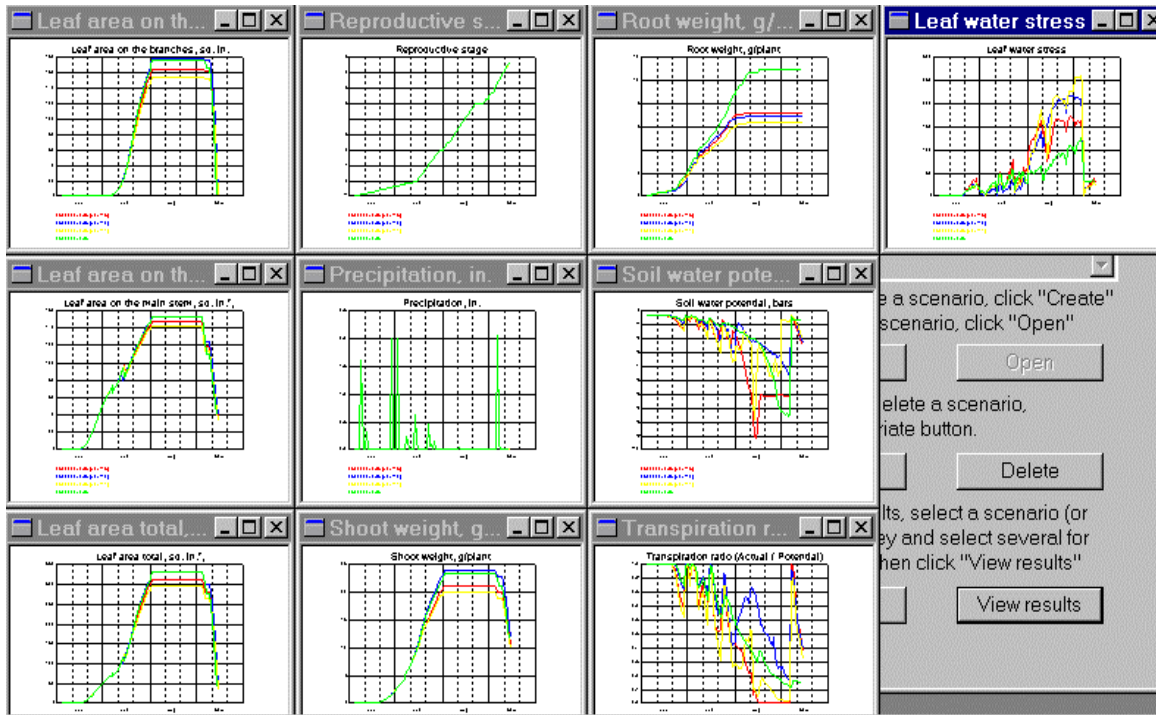
Click the 'Graphs' button in the 'View Results' window. The 'Select' window will be displayed with a list of variables that can be shown in the graphs. The content of the window is model-dependent. For the GLYCIM example, this window is shown at next page.



Not all variables are shown in the dialog box if the vertical scroll bar between buttons  and  is present. Click these buttons to scroll through the list and see other variables.

Select variables to graph by clicking the small square preceding the variable name. A checkmark in the square marks the selection. To deselect, click the square again. When all variables have been selected, press the 'OK' button. To quit viewing graphs, press the 'Cancel' button.









Each graph will be shown in a separate window, one window per variable.



Different colors are used to display the result of different scenarios. Names of scenarios will be written under graphs in the same colors as their curves.

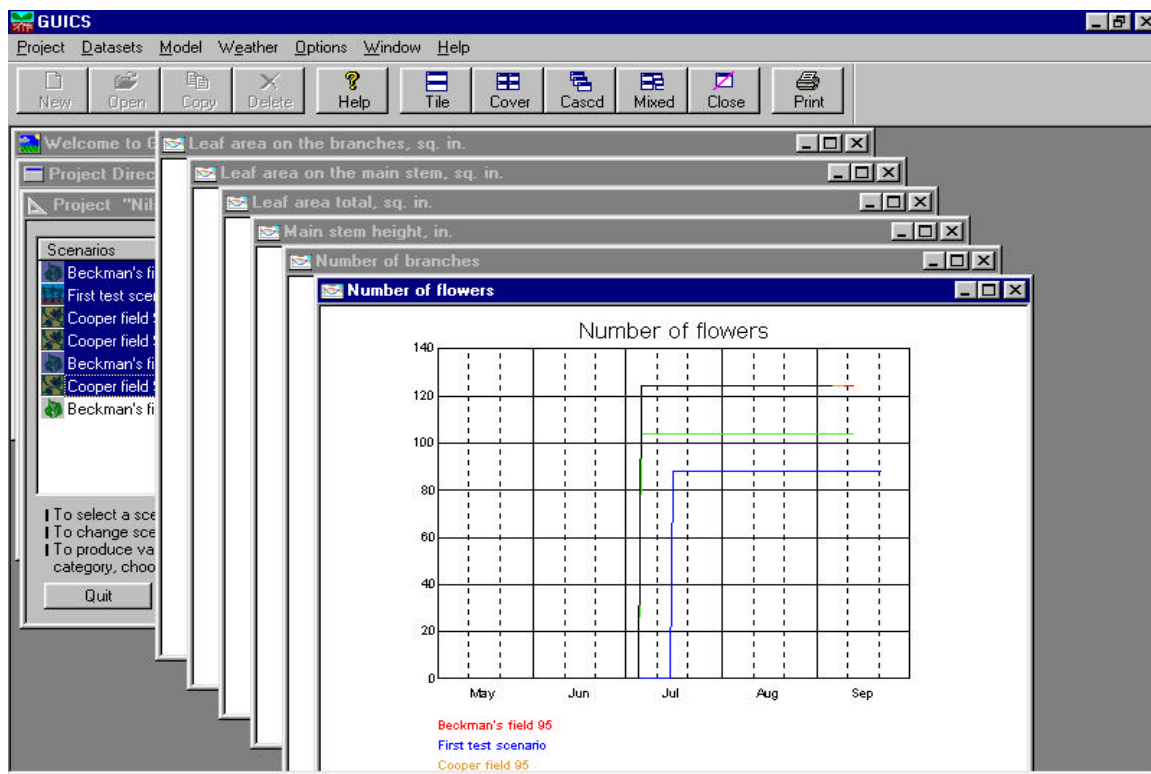
3.2.2 Manipulating graphs

Manipulating graphs means resizing them, temporarily or permanently removing them from the screen, and repositioning them.

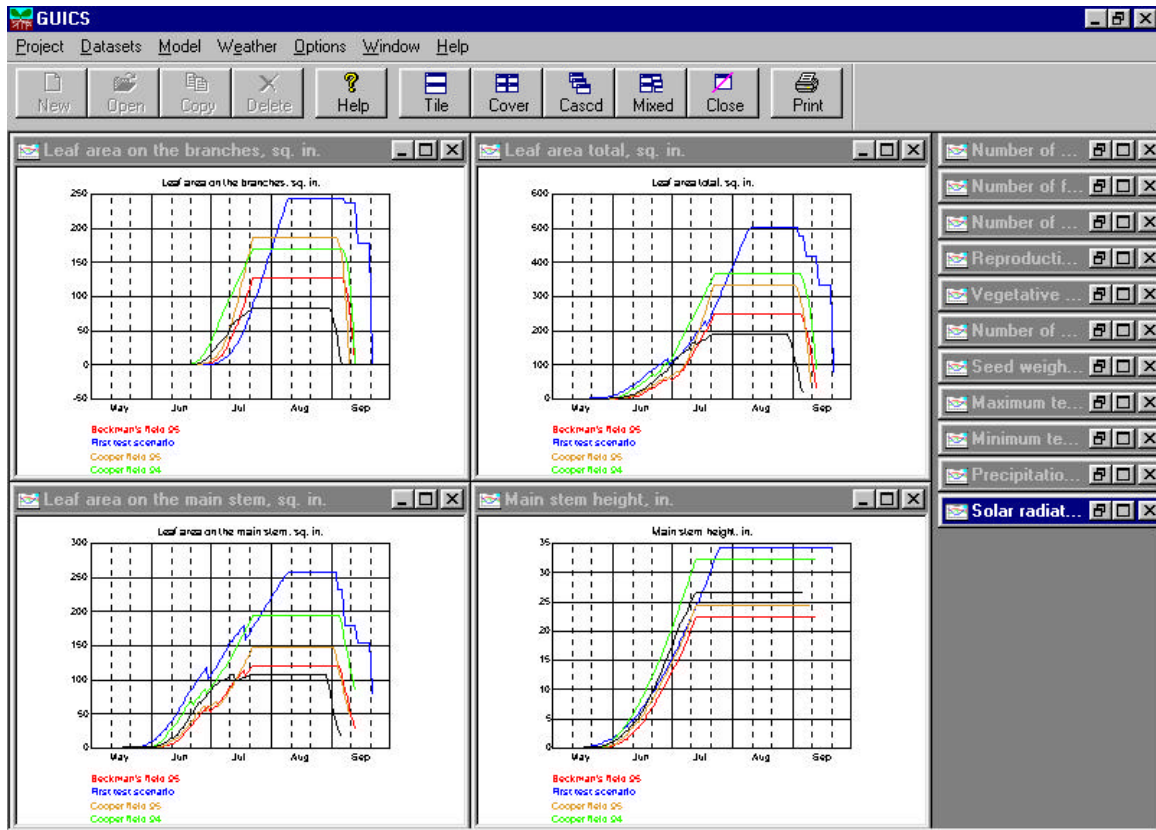
The toolbar buttons     and  and individual graph window buttons    are used to manipulate the graphs.

The toolbar button 'Cover' positions graphs in columns. This is the way the graphs are shown initially. The number of columns depends on the number of variables selected. Selection of a single variable results in one graphs shown, graphs of two to four variables, five to nine variables, ten to sixteen variables, and more than sixteen variables will be shown in two, three, four, and five columns, respectively. The sequence of graphs in the columns is the same as the sequence of selected variables in the 'Select' window shown at previous page.

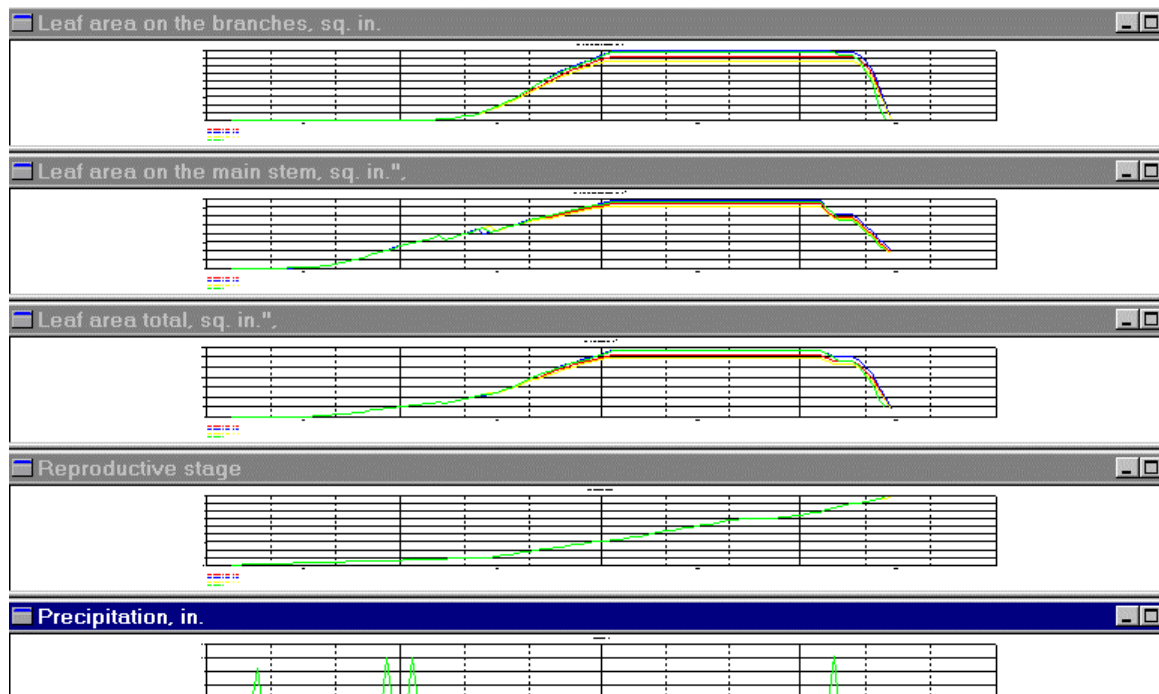
The toolbar button 'Cascd' cascades graphs as shown below.




The toolbar button 'Mixed' is useful if more than four variables are selected. Graphs of first four variables are displayed, and the rest of the variables are represented by the title bars of their windows.





The toolbar button 'Tile' tiles all the graphs as shown below.





The toolbar button ‘Close’ closes all graphs and returns you to the current project window with the list of scenarios.

The window button  minimizes the graph leaving visible only the title bar of the graph window.

The window button  toggles between the graph’s regular and maximum size.


The window button  removes the graph from the screen permanently.

Graphs may be too small to view if their total number is large. There are several ways to resize graphs and to make them more readable.

Any graph can be maximized by clicking its window button . To undo maximizing, click the button  on the menu bar. This button is marked with an arrow in the figure below.



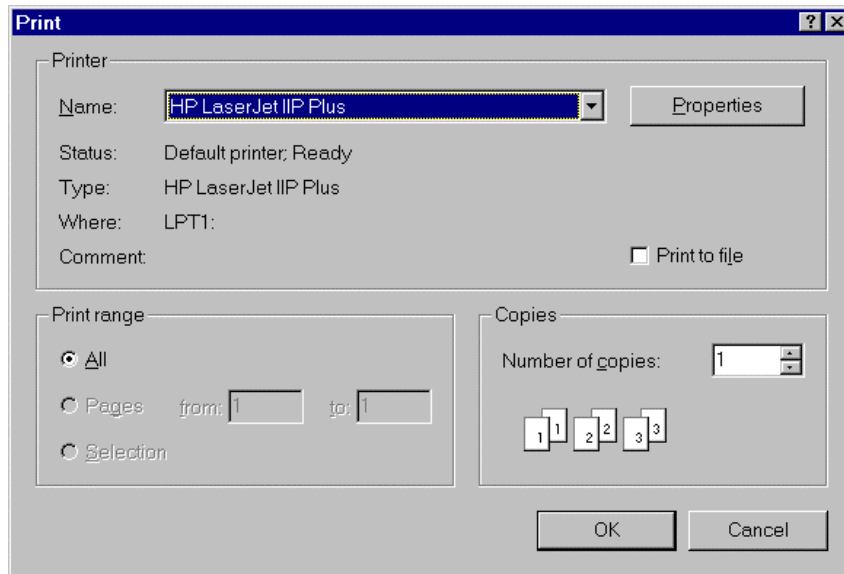
You can cascade graphs by clicking the ‘Cascd’ button and then click the title bar of the graph window to see the enlarged graph you want.

You can remove all graphs but the ones you need by clicking graph window buttons . Then use the ‘Cover’ button or the ‘Tile’ button to position the graphs.

You can move graph windows around the screen by pressing the mouse left button and dragging the graph. Release the button when the graph is where you want it.

3.2.3 Printing graphs

You may print one graph at a time. Select the graph by clicking its window, and press the toolbar button ‘Print’. You will see the ‘Print’ window of Windows 95.

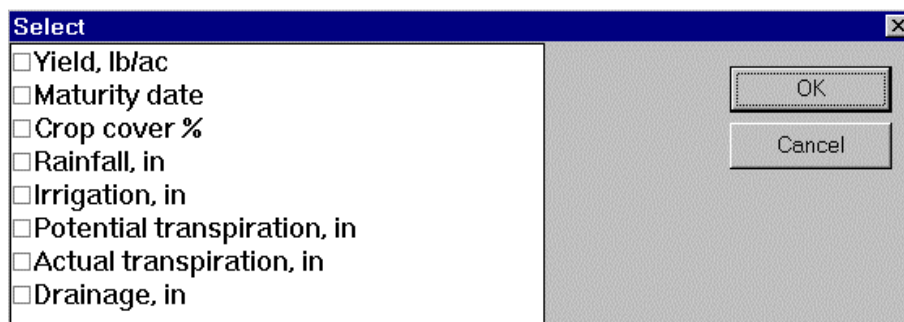




Check the properties of your printer before first printing. Press the ‘Properties’ button and check or change the paper size and the paper orientation. You may experiment with the bookmarks ‘Graphics’, ‘Fonts’ and ‘Device options’ to get the best results for your computer system. Press the ‘OK’ button to return to the ‘Print’ window when you finish with the bookmarks. Then press ‘OK’ in this window to obtain your printout.

3.3 Viewing tables

3.3.1 Selecting variables to tabulate

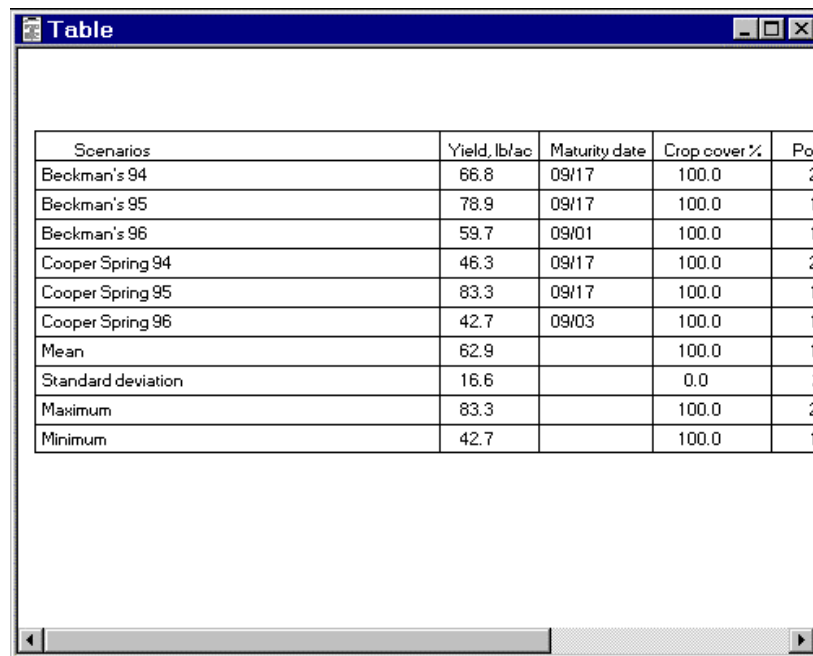
Click the ‘Tables’ button in the ‘View results’ window. The ‘Select’ window will be displayed with a list of variables that can be shown in tables. The content of the window is model-dependent. For the GLYCIM example, this box is shown below.



Not all variables are shown in the dialog box if the vertical scroll bar between buttons  and  is present. Click these buttons to scroll through the list and see other variables.



Select variables to tabulate by clicking the small square preceding the variable name. A checkmark in the square marks the selection. To deselect, click the square again. When all


variables have been selected, press the 'OK' button. To quit viewing tables, press the 'Cancel' button. The table will be displayed. A GLYCIM example is shown below.



Scenarios	Yield, lb/ac	Maturity date	Crop cover %	Position
Beckman's 94	66.8	09/17	100.0	2
Beckman's 95	78.9	09/17	100.0	1
Beckman's 96	59.7	09/01	100.0	1
Cooper Spring 94	46.3	09/17	100.0	2
Cooper Spring 95	83.3	09/17	100.0	1
Cooper Spring 96	42.7	09/03	100.0	1
Mean	62.9		100.0	1
Standard deviation	16.6		0.0	1
Maximum	83.3		100.0	2
Minimum	42.7		100.0	1

Each table contains scenario names and the values of the selected variables. If the number of selected scenarios is greater than three, the table will also contain mean, standard deviation, minimum and maximum values for each variable.

If the number of selected variables is too large to display all the columns, the horizontal scroll bar will appear between control buttons  and . Use these buttons to scroll across the columns.

To quit viewing tables, press the toolbar button 'Close' or the window button .

3.3.2 Printing tables

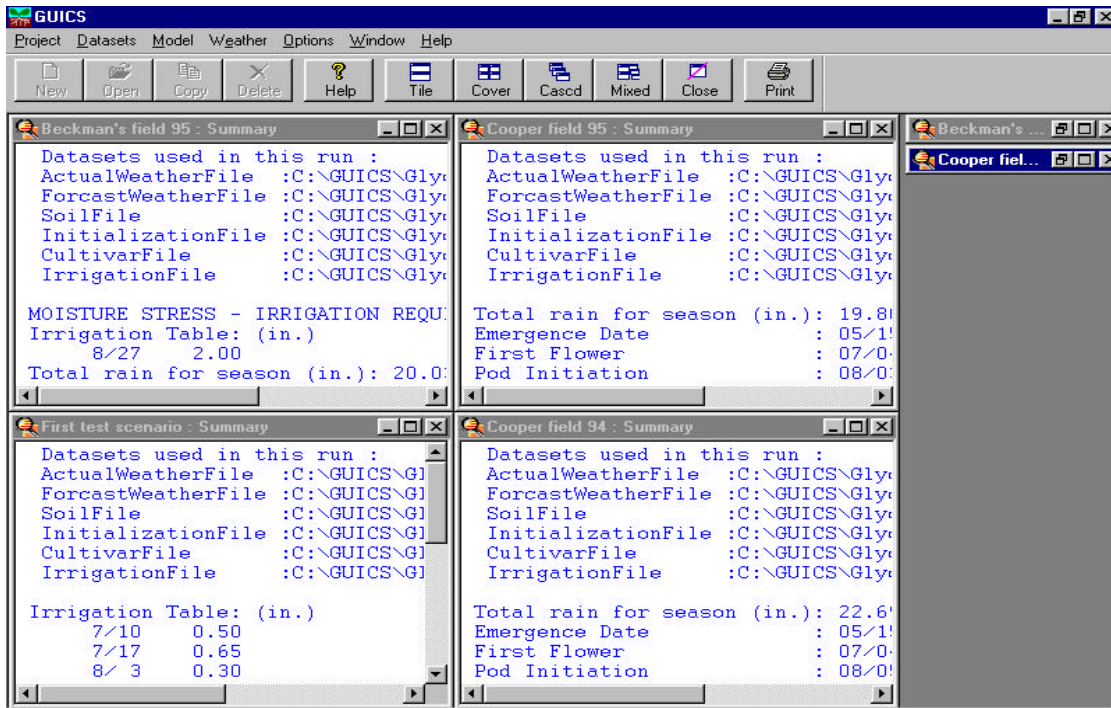
Press the toolbar button 'Print'. For instructions on using the 'Print' window, refer to the section 3.2.3 'Printing graphs'. Tables should be printed with the landscape paper orientation.

3.4 Viewing Summaries and Reports

3.4.1 Displaying summaries and reports

A summary is a small text file containing essential information about the results of a scenario. Reports are full size detailed output files of the models.

Summaries or reports will be shown for each of the selected scenarios after pressing the ‘Summaries’ or ‘Reports’ buttons, respectively. For the GLYCIM example, summaries of six scenarios will be displayed as shown below.

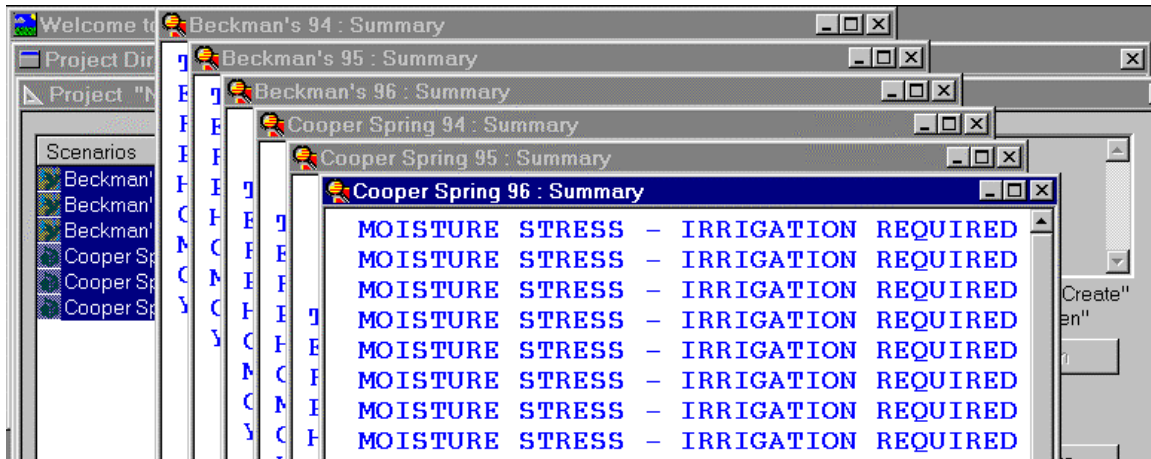


To browse through summaries or reports use the vertical and horizontal scroll bars and control buttons , , , and .

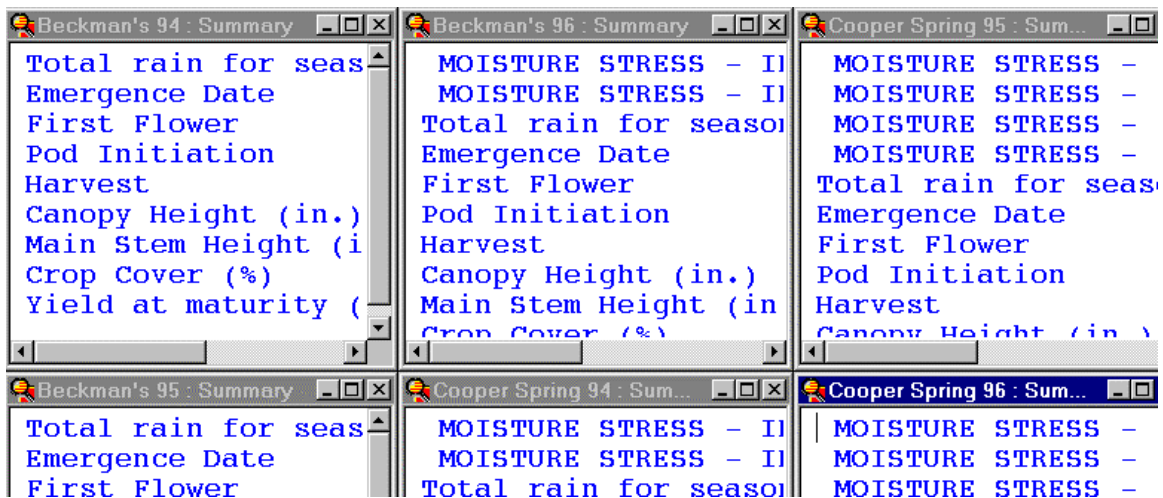
The toolbar buttons , , , , , and individual summary window buttons are used to change the appearances of summaries and reports.

The ‘Mixed’ toolbar button positions summaries and reports in columns as shown above. Summaries or reports of the first four scenarios are tiled, and the rest of the summaries or reports are represented by the title bars of their windows.

The toolbar button ‘Cascd’ cascades summaries and reports as shown below.







The toolbar button 'Cover' positions summaries or reports in columns:





The toolbar button 'Tile' positions all summaries or reports in a pile.

The toolbar button 'Close' closes all summaries or reports and returns you to the current project window.

The window button  minimizes a summary or report window leaving visible only the title bar of the window.

The window button  maximizes the summary or report to almost fill the screen. To undo maximizing, click the button  on the menu bar. This button is marked with an arrow  in the figure below.



The window button  removes the summary or report from the screen permanently. You can remove all summaries or reports except those that you need by clicking the summary or report window buttons .

You can move summary or report windows around the screen by pressing the mouse left button and dragging the window. Release the button when the summary or report is where you want it.

3.4.2 Printing summaries and reports

Press the toolbar button 'Print'. For instructions on using the 'Print' window, refer to the section 3.2.3 'Printing graphs'. Summaries and reports should be printed with the portrait paper orientation.

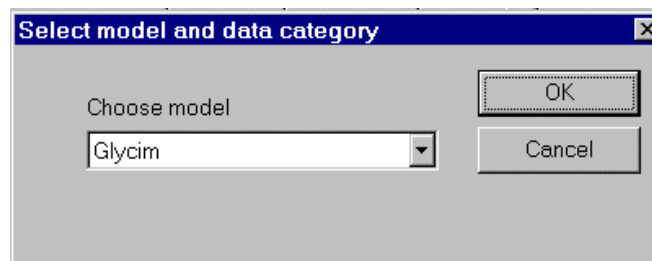
Chapter Four: *Working with Datasets*

Working with datasets means creating, editing, importing, or exporting datasets.

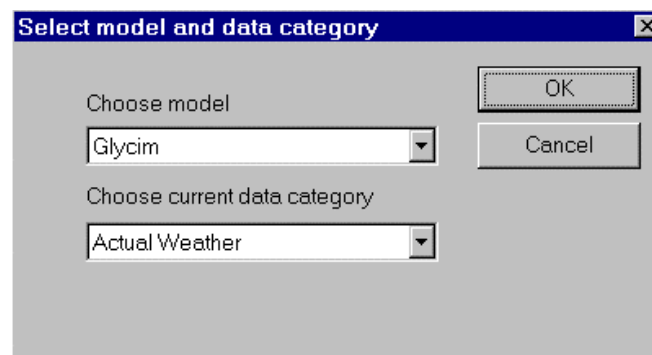
4.1 *Selecting a Data Category*

Datasets in GUICS are divided into data categories, like weather data, soil data, cultivar data, etc. Each category has its own data structure. Therefore, to work with a dataset, you need to select the data category first.

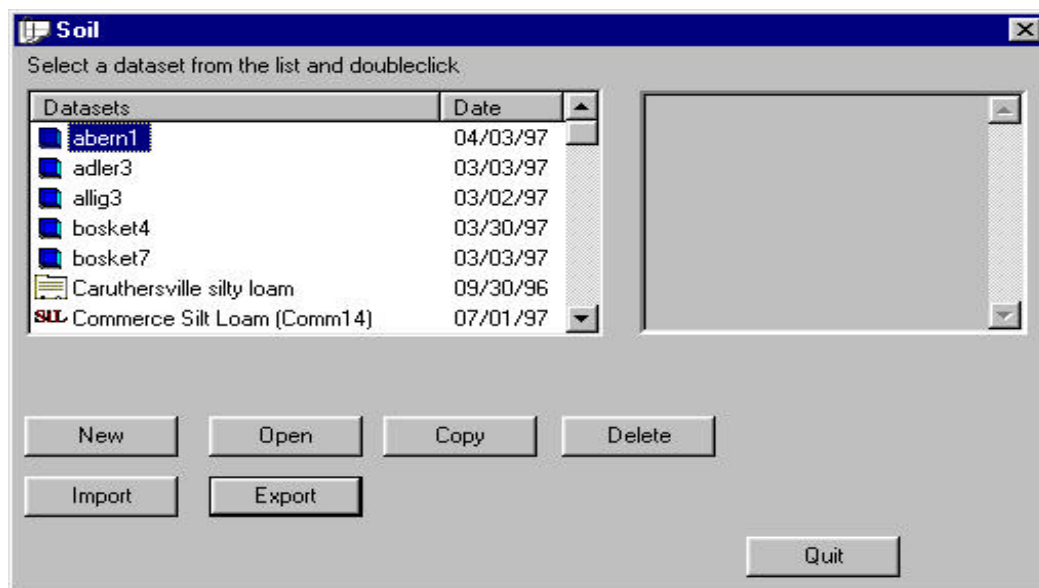
Click the 'Datasets' item on the menu bar. The 'Select model and data category' window will be displayed.



The combo box contains the list of models currently plugged into your version of GUICS. Press the ▾ button to see the list. Click the name of the model you want to work with. Another combo box will be displayed which has a list of data categories for the model you have selected.

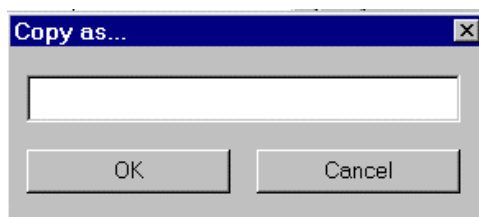


Press the ▾ button to see the list. Click the appropriate data category. Click 'Cancel' if you want to quit working with datasets. Click 'OK' to proceed. You will see the data category window containing the list of available datasets and the control buttons 'New', 'Open', 'Copy', 'Delete', 'Import', 'Export' and 'Quit'. These buttons are used to work with the datasets. Additional buttons are used to refresh weather data with data obtained from a weather station (see Chapter 5 'Updating weather datasets using weather stations'). An example of a data category window is shown at next page.



4.2 Copying a Dataset

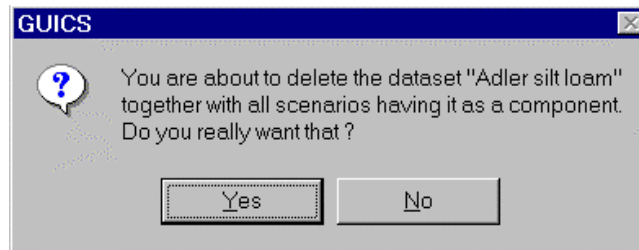
To copy a dataset, press the 'Copy' button in the data category window. You will be prompted to give a name to the dataset copy:



Type the new name and click 'OK'. The copy will be created and its name will appear in the list of datasets. You may want to update its memo and/or icon (see Section 4.4).

4.3 Deleting a Dataset

To delete a dataset, select the dataset and press the 'Delete' button in the data category window. A warning message will be displayed that contains the name of the dataset:

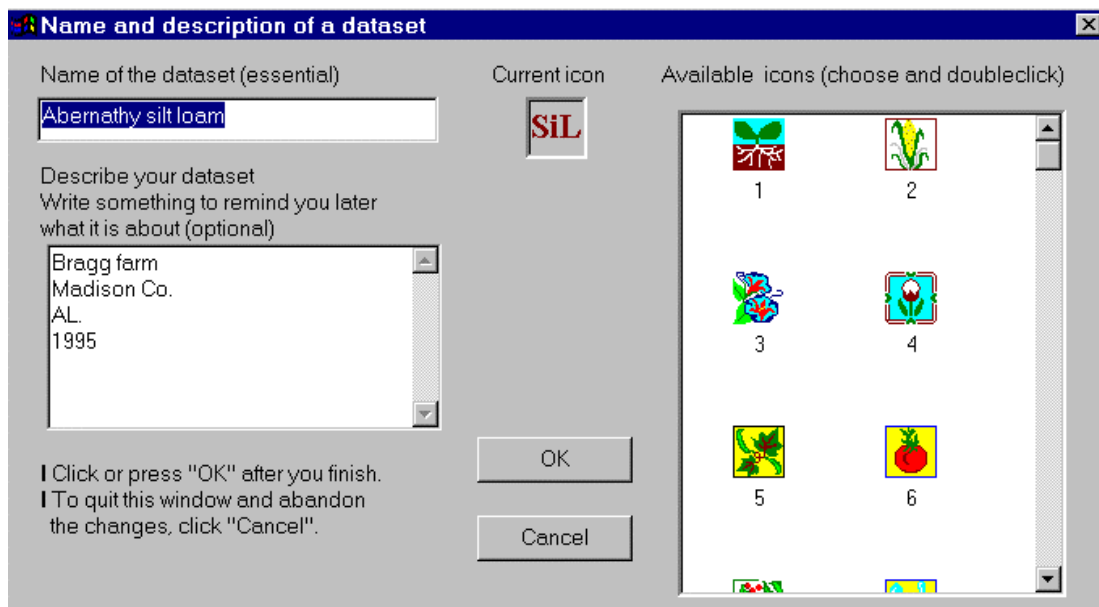


Click 'Yes' to delete or 'No' to prevent the deletion. If 'Yes' is pressed, the data set will be removed permanently and its name will disappear from the dataset list.

All scenarios containing deleted component will be deleted.

4.4 Editing or Reviewing a Dataset

To edit or to review a dataset, select it and press the 'Open' button in the data category window. First you will see the 'Name and description of a dataset' window.



Make changes if needed and press 'OK' to continue. The 'Edit Dataset' window will appear and in it you will see all data in the dataset in the same sequence as they are read by the model code.

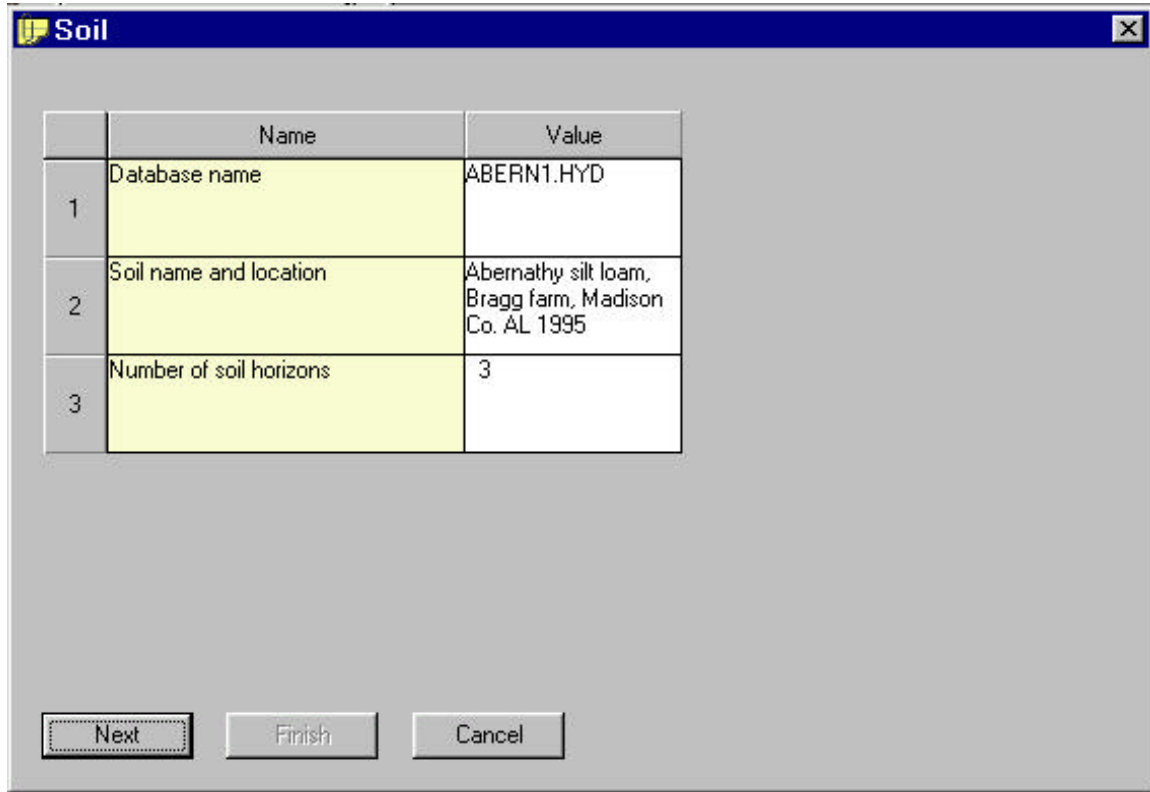
Single value entries will be shown in a two-column table as demonstrated by the GLYCIM example at the next page.

You can edit values appearing in the right column. To update an entry in the table, doubleclick it and make changes there.

Use the scroll bar to locate what you need to change. To change the contents of a cell, place the cursor in a cell, make the changes, and scroll to a next variable.

When you are through editing this table, press the 'Next' button. This will send you to the next table if it exists, otherwise you will leave the editing mode.

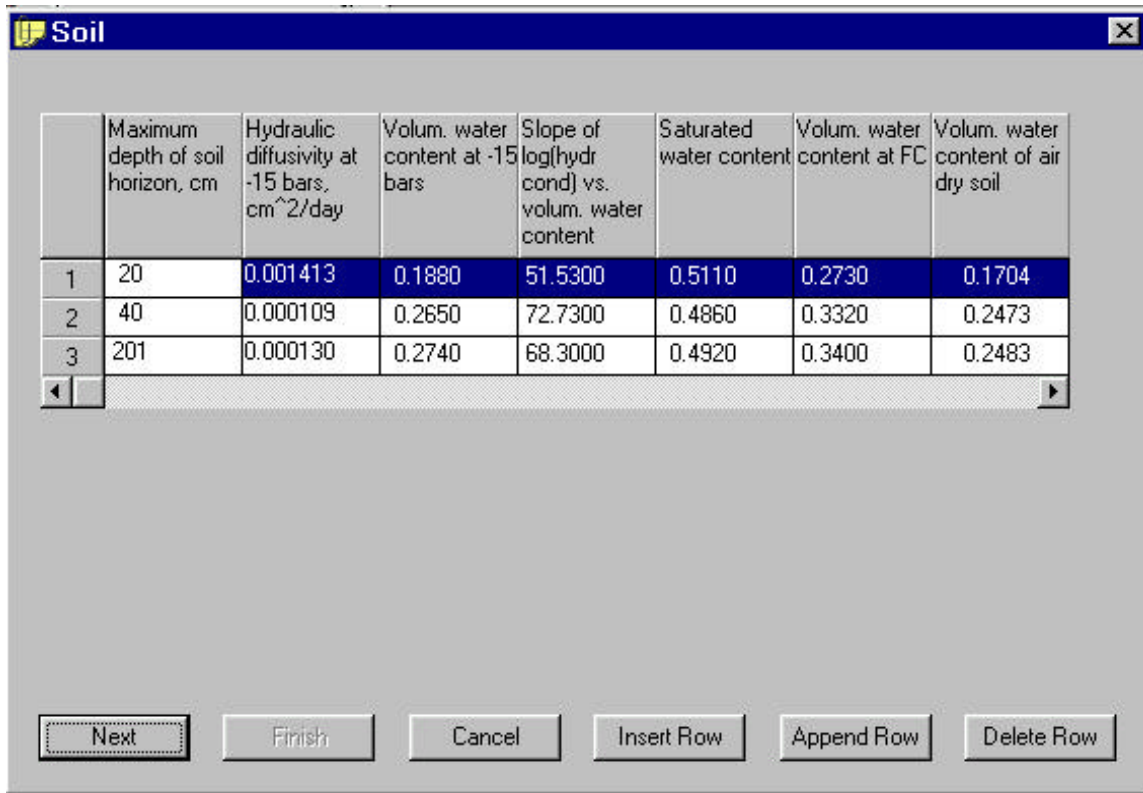
Pressing the 'Cancel' button will discard all changes that have been made previously.



	Name	Value
1	Database name	ABERN1.HYD
2	Soil name and location	Abernathy silt loam, Bragg farm, Madison Co. AL 1995
3	Number of soil horizons	3

Next Finish Cancel

Arrays will be shown in a tabular form. For the GLYCIM example, one such entry is shown below.



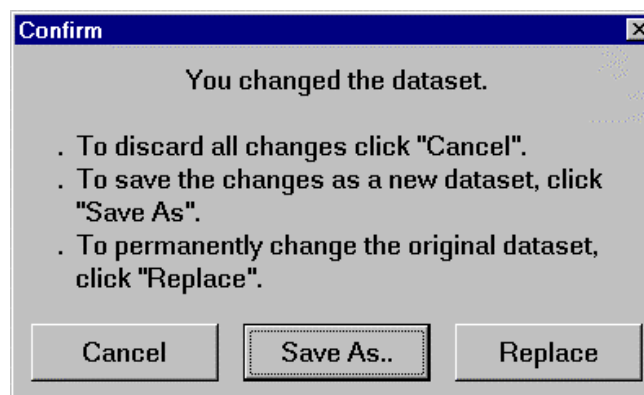
The 'Soil' window displays a table with 8 columns: an index column, 'Maximum depth of soil horizon, cm', 'Hydraulic diffusivity at -15 bars, cm²/day', 'Volum. water content at -15 bars', 'Slope of log(hydr cond) vs. volum. water content', 'Saturated water content', 'Volum. water content at FC', and 'Volum. water content of air dry soil'. The first three rows are populated with data. Below the table are buttons for 'Next', 'Finish', 'Cancel', 'Insert Row', 'Append Row', and 'Delete Row'.

	Maximum depth of soil horizon, cm	Hydraulic diffusivity at -15 bars, cm ² /day	Volum. water content at -15 bars	Slope of log(hydr cond) vs. volum. water content	Saturated water content	Volum. water content at FC	Volum. water content of air dry soil
1	20	0.001413	0.1880	51.5300	0.5110	0.2730	0.1704
2	40	0.000109	0.2650	72.7300	0.4860	0.3320	0.2473
3	201	0.000130	0.2740	68.3000	0.4920	0.3400	0.2483

To update an entry in the table, doubleclick it and make the changes there. If you need to insert a row, append a row, or delete a row, use the appropriate button at the bottom of the window. An inserted empty row will be placed before the row in which one of the entries has been highlighted. After all changes have been made, press the 'Next' button to proceed. Pressing the 'Cancel' button will delete all changes that have been made previously.

If no changes have been made, you will be returned to the data category window when the data set ends.

If you have made changes, a warning window will be displayed.



The 'Confirm' dialog box contains the text 'You changed the dataset.' followed by three bullet points: 'To discard all changes click "Cancel".', 'To save the changes as a new dataset, click "Save As".', and 'To permanently change the original dataset, click "Replace".'. At the bottom are three buttons: 'Cancel', 'Save As..', and 'Replace'.

You can choose (a) to save the modified dataset under a new name using the ‘Save as...’ button, or (b) to save it under the original name using ‘Replace’ button, or (c) to cancel all changes. **All scenarios containing changed dataset will receive status ‘Assembled’.**

4.5 Creating a New Dataset

To create a dataset, press the ‘New’ button in the current data category window. First, you will see the ‘Name and description of a dataset’ window.

Type the name of the dataset. Writing a memo is recommended. To select an icon, doubleclick it.

Click the ‘Cancel’ button if you decide to abandon this dataset.

Click ‘OK’ when finished with the name, the memo, and the icon. You will be guided through all the entries of the data set. Some default values or character strings will be shown and you must replace them with the entries of the new dataset.

Single value entries will be shown in a two-column table as demonstrated by the GLYCIM example below. You can edit values appearing in the right column after doubleclicking them. Use the scroll bar to locate what you need to change. To change the contents of a cell, place the cursor in a cell, make the changes, and scroll to a next variable.

When you are through editing this table, press the ‘Next’ button. This will send you to the next table if it exists, otherwise you will leave the editing mode.

Pressing the ‘Cancel’ button will discard all changes that have been made previously.

	Name	Value
1	Database name	ABERN1.HYD
2	Soil name and location	Abernathy silt loam, Bragg farm, Madison Co. AL 1995
3	Number of soil horizons	3

Next Finish Cancel

Arrays will be shown in a tabular form. For the GLYCIM example, one such entry is shown below.

To change a default value or an earlier entry in the table, doubleclick it and use keyboard key to edit a number.

If you need to insert a row, append a row, or delete a row, use the appropriate button at the bottom of the window. When inserting a row, an empty row will be placed before the row with a highlighted entry.

After all the data changes have been entered, press the 'Next' button to proceed. Pressing the 'Cancel' button will delete all entries that have been made previously.

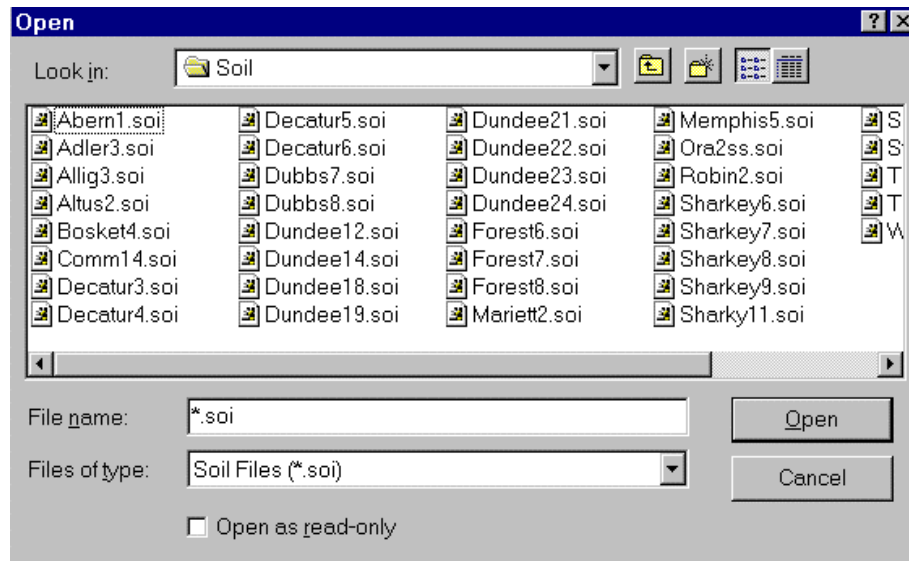
When the dataset is complete, you will be returned to the current data category window.

Soil							
	Maximum depth of soil horizon, cm	Hydraulic diffusivity at -15 bars, cm ² /day	Volum. water content at -15 bars	Slope of log(hydr cond) vs. volum. water content	Saturated water content	Volum. water content at FC	Volum. water content of air dry soil
1	20	0.001413	0.1880	51.5300	0.5110	0.2730	0.1704
2	40	0.000109	0.2650	72.7300	0.4860	0.3320	0.2473
3	201	0.000130	0.2740	68.3000	0.4920	0.3400	0.2483

4.6 Importing a Dataset

A dataset in ASCII format can be imported from any drive of the computer in use. You have to select a model and a data category (see Section 4.1) and then click the 'Import' button in the data category window. The 'Open' dialog box will be displayed.

Use the 'Look in' combo box to locate the file to import. Then click the filename and the 'Open' button.



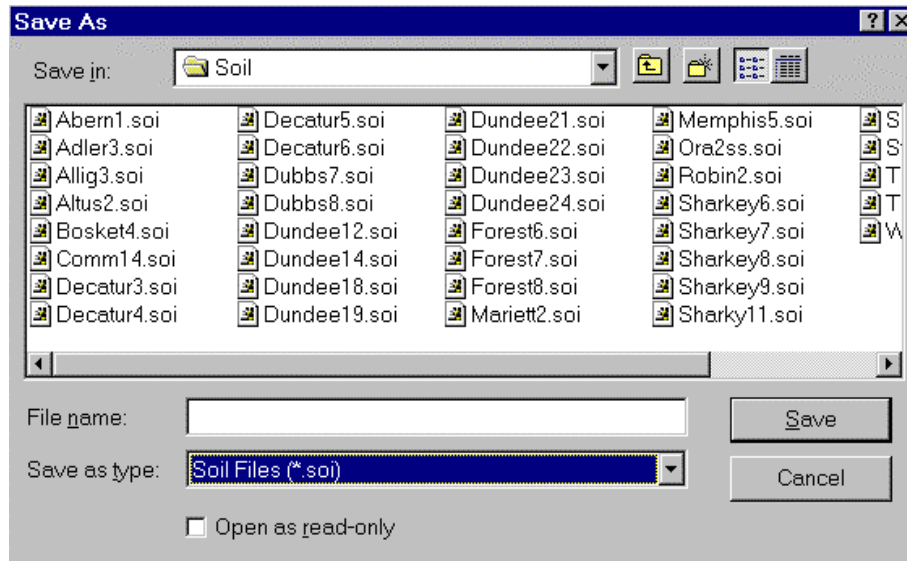
The window 'Name and description of a dataset' will be displayed. Type the name of the dataset. Any combination of characters can be used. Up to 40 symbols are permitted. Writing a memo is recommended. To select an icon, doubleclick it.

Click the 'Cancel' button if you decide to abandon this dataset.

Click 'OK' when finished with the name, the memo, and the icon. You will return to the current data category window. The imported dataset will be listed among the others.

4.7 Exporting a Dataset

A dataset can be exported in ASCII format to any drive and folder of the computer in use. You have to select a model and a data category (see Section 4.1), then click the 'Export' button in the current data category window. The Windows 'Save As' dialog box will be displayed.



Use the 'Save in' combo box to locate the destination drive and folder. Then type the filename in the 'File name' editing box and click the 'Save' button.

4.8 Accessing a Dataset During a Scenario Review

Any dataset can be accessed directly from the list of datasets in the boxes that are shown when you edit or create new scenario. Doubleclick the name of the dataset in the list box. The 'Name and Description of a Dataset' window appears. Refer to the section 4.4 'Editing or Reviewing a Dataset' for further instructions.

Chapter Five: *Updating Weather Datasets Using Weather Stations*

GUICS allows you to download data from weather stations manufactured by Campbell Scientific, Inc., and to update weather datasets used in simulations. You need a modem in your computer system to download data.

GUICS operates with two versions of weather data files. Weather datasets are text files that contain daily weather variables. These files are used in simulations and can be accessed as described in Chapter 4 of this manual. Raw weather files contain all the data coming from the weather stations, that is all information that the station collects each 15 minutes, hourly, and daily. These data are binary strings, i.e., sequences of zeros and ones. Raw weather data files are used to update the weather datasets. You do not have a direct access to raw weather data.

Updating weather datasets is a two-stage operation. First, you call a weather station, and GUICS will automatically update the raw weather data file associated with this weather station. Second, you access the weather dataset that you want to update, and use 'Refresh' or 'Patch' options to add the new information from the station in this dataset.

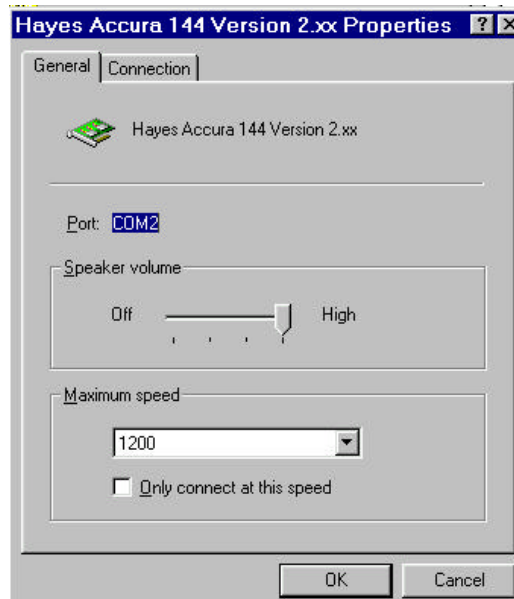
Calling weather station alone does not update the weather data that you use in simulations.

Sections 5.1-5.5 of this chapter explains how to update raw weather data files. Sections 5.6-5.7 shows how to update your weather dataset using the raw weather data files.

5.1 *Checking modem settings*

Make sure that your modem is set properly.

1. Click the 'Start' button at the taskbar.
2. Click the 'Settings' program group.
3. Click the 'Control Panel' program group.
4. Click the 'Modems' icon. The 'Modems Properties' window will be displayed.
5. Click the 'Dialing Properties' button. The 'Dialing Properties' window appears. Check the content of all boxes. Click 'OK' if everything is set correctly in this window. You will be returned to the 'Modems Properties' window.
6. Click the 'Properties' window. The window of properties specific to your modem will be shown.

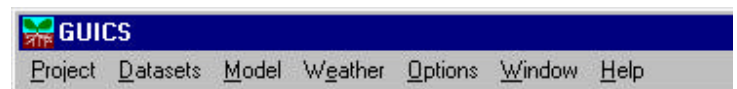


Make sure that the box 'Only connect at this speed' **is not** checkmarked.

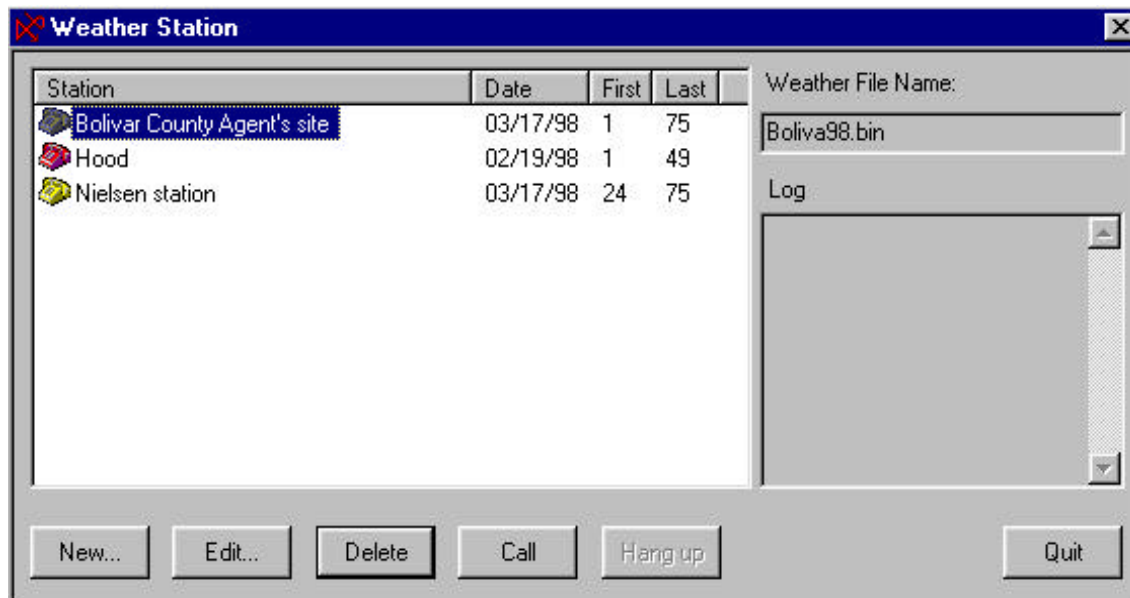
7. Click the 'Connection' bookmark. Click the 'Advanced' button. Make sure that the box 'Use flow control' **is** checkmarked.
8. Click 'OK' in this window, and continue OK until you are in 'Control panel' group.

5.2 Setting a New Weather Station

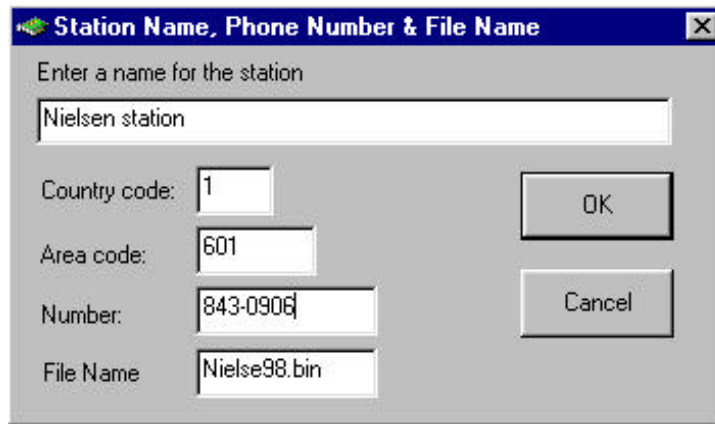
Click 'Weather' at the GUICS menu bar:



The 'Weather Station' window will be shown.



Click the 'New...' button. The 'Station Name, Phone Number & File Name' window will be shown.



Give a name to the station. Make it descriptive. If you use several stations, do not start their names with the same word. The country code is 1 for the USA. You may use dashes within the phone number.

Click 'OK'. You will return to the 'Weather Station' window. It will display the new station name, the phone number, and the name of the raw weather file.

The name of raw weather data file is formed in GUICS automatically by taking first six letters of the first word in the station name and adding two last digits of the current year. The whole first word will be used if it contains less than 6 letters. For example, in 1997, the station 'Cooper Field' will be associated with the raw weather file data 'cooper97', and the station 'My new station' will be associated with raw weather data file 'my97'.

You can change the name that has been given automatically by editing it before clicking 'OK' button in the 'Station Name, Phone Number & File Name' window.

Check the station name and the phone number. Edit the station properties if you see an error (see Section 5.3).

The new station has the 'white phone' icon.

5.3 Editing a Weather Station

Select the station by clicking its name in the 'Weather Station' window and click the 'Edit' button. The 'Station Name, Phone Number & File Name' window will be shown. Make changes in the boxes, and press 'OK'.

We do not recommend changing the name of a station during a year.

5.4 Deleting a Weather Station

Click the 'Delete' button in the 'Weather station' window. A warning will be displayed:



Click the 'Yes' button, and the last selected station will be deleted. You may only delete one station at a time.

5.5 Calling a Weather Station

Click 'Weather' at the GUICS menu bar:



The 'Weather Station' window will be shown.

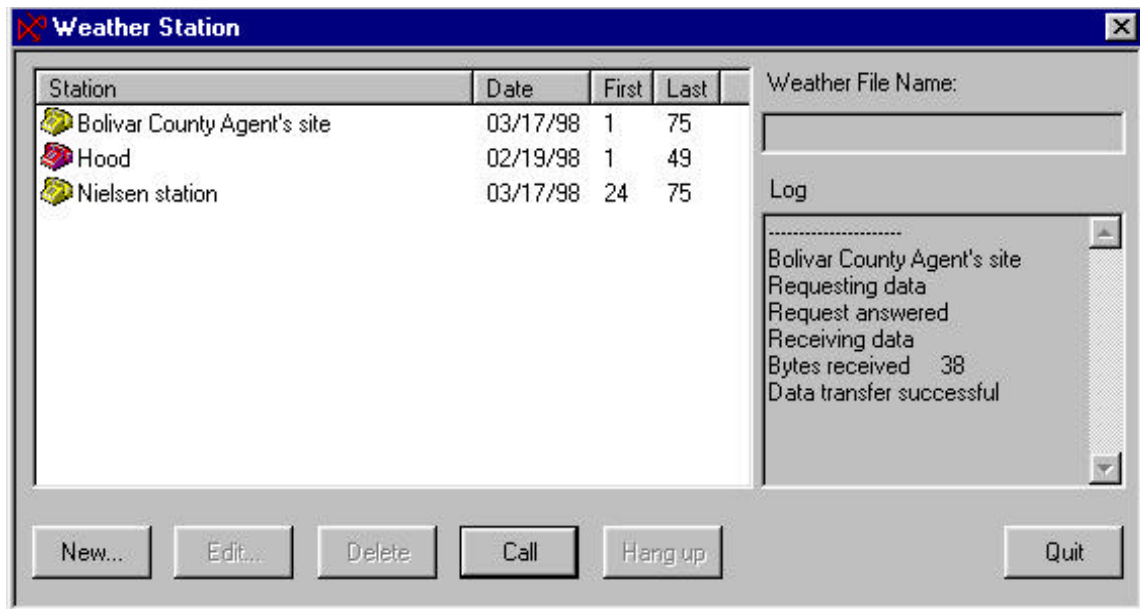
The 'yellow phone' icons mark stations that has been called less than two weeks ago. The 'red phone' icons mark stations that has been called more than two weeks ago. The 'green phone' icons mark stations that have been used in the past but cannot be used now.

Click the 'Call' button. You will probably hear the characteristic sound of the modem connection. Watch the log portion of the window for updates on the modem's progress.

You may disconnect the calling session by clicking the 'Hang up' button.

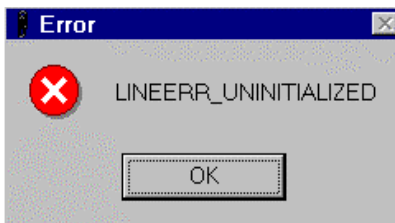
After the modem is finished, the 'Call' button will become active again. To verify if the data transfer was successful, scroll through the log by using the arrows on the right side of the log area.

You may call multiple weather stations in succession by selecting more than one before pressing the 'Call' button. GUICS will begin with the last weather station on the list and call each selected station until it reaches the beginning of the selected list.



A new raw weather file will be created for a weather station after calling it in the beginning of a new year. The name of this file will include the current year. The old raw weather file will still exist and can be used to refresh or patch weather data sets (see Sections 5.6 and 5.7 below). To show the presence of the old raw data file, the name of the station will be duplicated in the list of stations with the 'gray phone' – 'no calls' icon. You need to select the name of the station with the 'yellow phone' or the 'red phone' icon to call this station in the new year.

If your computer has problems with the modem connection or the station does not respond properly, you will receive one of the following messages: 'Error opening line', 'No valid modem handle', 'Total timeouts are not supported', 'Station does not answer', 'Cannot get info header'. If the connection can not be set properly, you may also receive error messages from the Windows 95 in the following form:



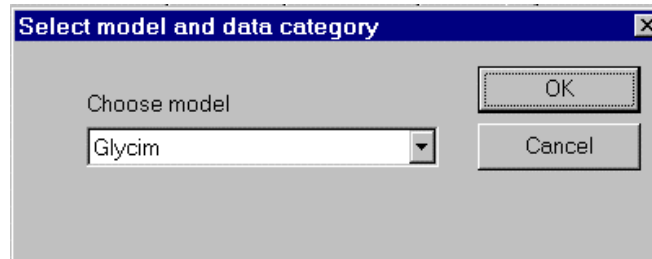
The text in this window may vary. Press 'OK' to return to GUICS.

Press the 'Quit' button to finish the calling session.

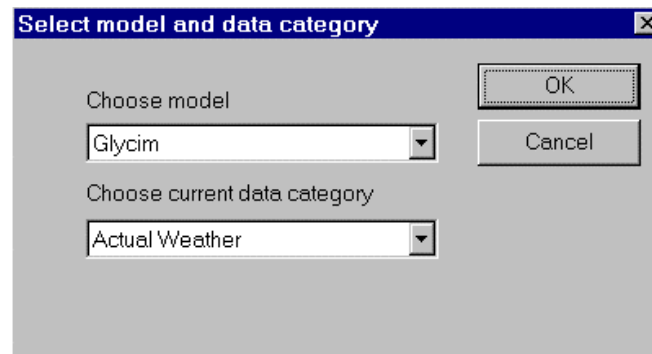
5.6 Refreshing a Weather Dataset

Refreshing a weather dataset means appending an existing set of weather data with new data that has been downloaded from a weather station.

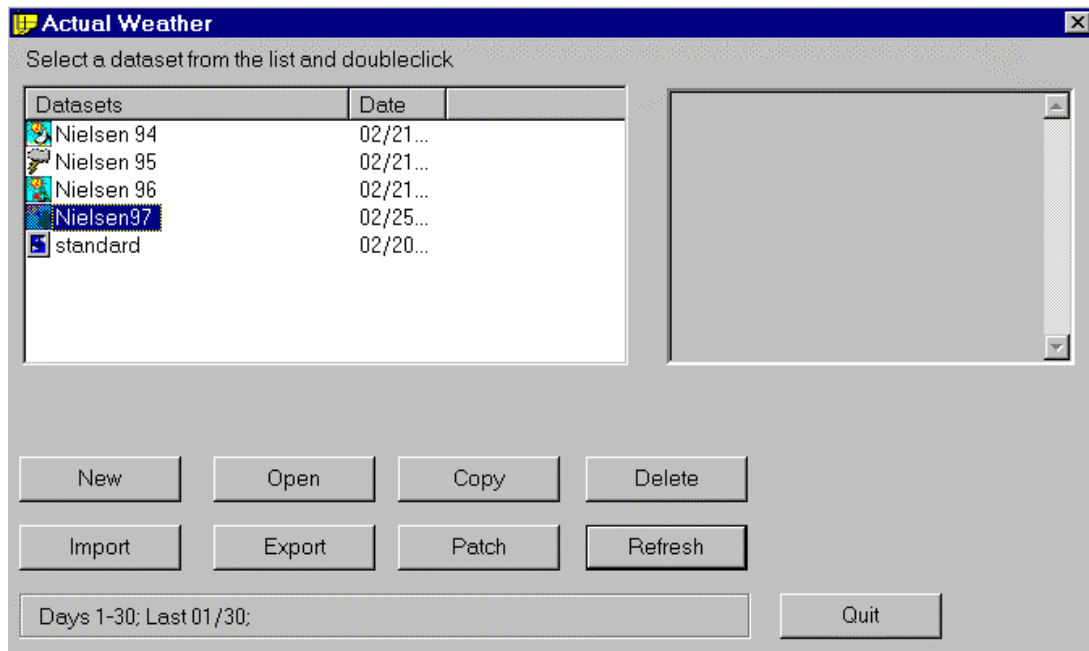
Click the 'Datasets' item on the menu bar. The 'Select model and data category' window will be displayed.



The combo box contains the list of models currently plugged into your version of GUICS. Press the ▾ button to see the list. Click the name of the model you want to work with and click 'OK' button. Another combo box will be displayed which has a list of data categories for the model you have selected.

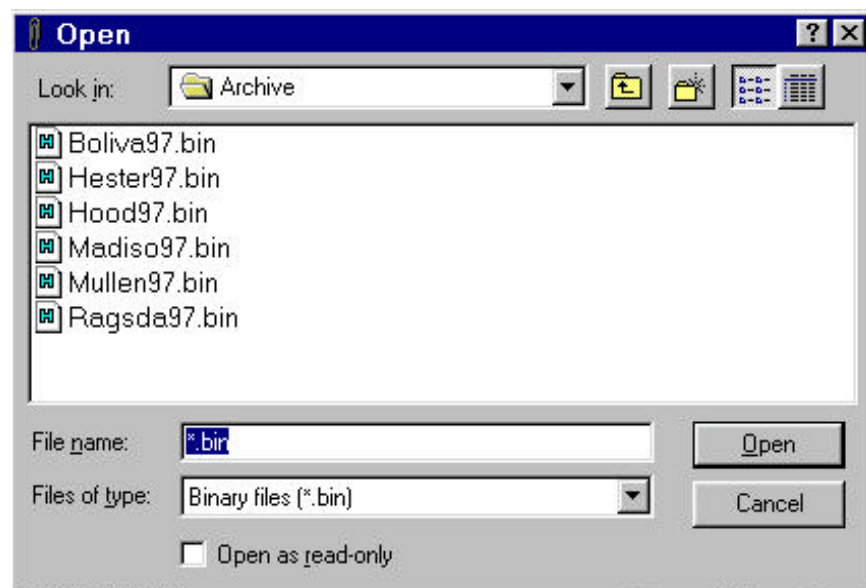


Press the ▾ button to see the list. Click the weather data category. It is the 'Actual Weather' category in GLYCIM example. Click 'OK' to proceed. You will see the data category window containing the list of available datasets and the control buttons 'New', 'Open', 'Copy', 'Delete', 'Import', 'Export', 'Quit', 'Refresh', and 'Patch'. The buttons 'Refresh', and 'Patch' are used to update weather data with data obtained from a weather station. An example of the 'Actual Weather' category window is shown at the next page.



Click the weather dataset that you want to update. The days of the year in the current dataset and the date of the last day in the file will be displayed at the bottom of the window.

Click the 'Refresh' button. The list of available raw weather data files will be shown in the 'Open' window. An example is shown below.

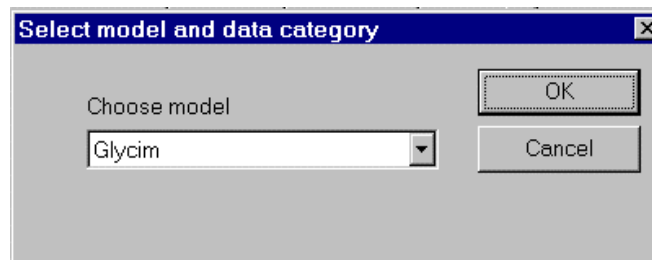


Click the raw data file you want to use in the update and click the 'Open' button. You will return to the 'Actual weather' window. The days of the year and the last date will be changed showing the update. **No new data have been downloaded if no change in the last date occurs.** Press the 'Quit' button when you have finished.

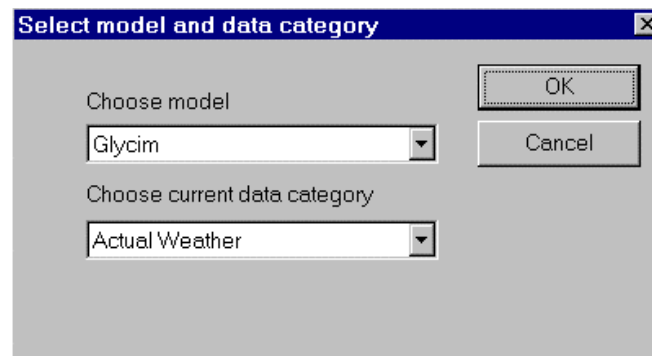
5.7 Patching a Weather Dataset

Patching a weather dataset means replacing data for several sequential days. This operation may be useful when the dataset has gaps in the sequence of the day numbers. The gaps may be due the station breakdown or due to late downloading of data from the station. Data from another station may be used to repair or replace data within a dataset.

Click the 'Datasets' item on the menu bar. The 'Select model and data category' window will be displayed.

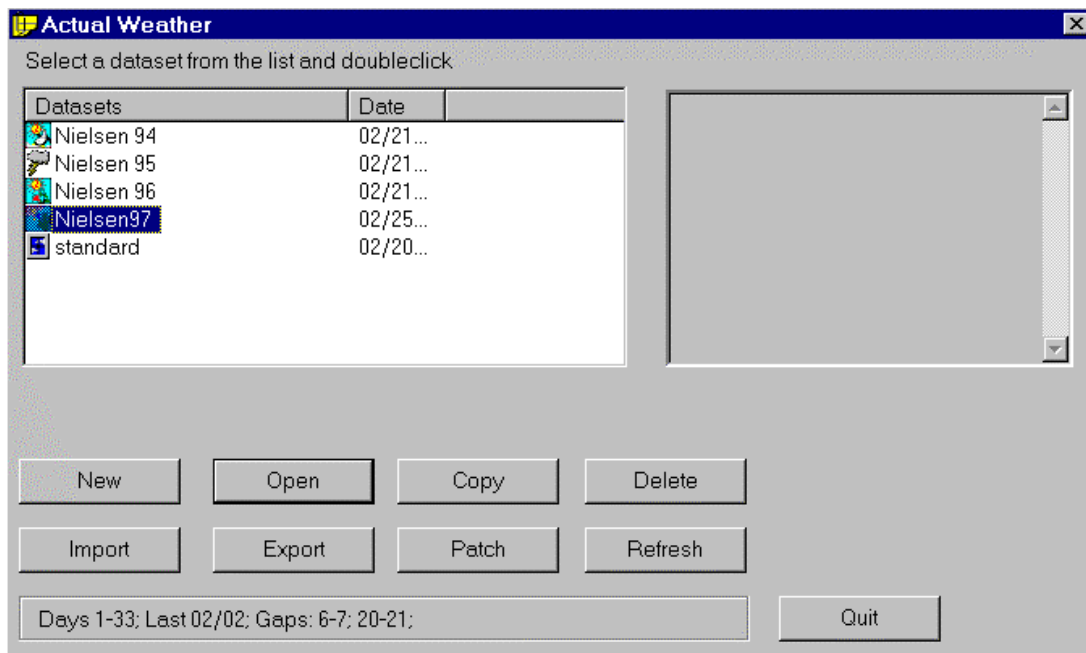


The combo box contains the list of models currently plugged into your version of GUICS. Press the ▾ button to see the list. Click the name of the model you want to work with and click 'OK' button. Another combo box will be displayed which has a list of data categories for the model you have selected.

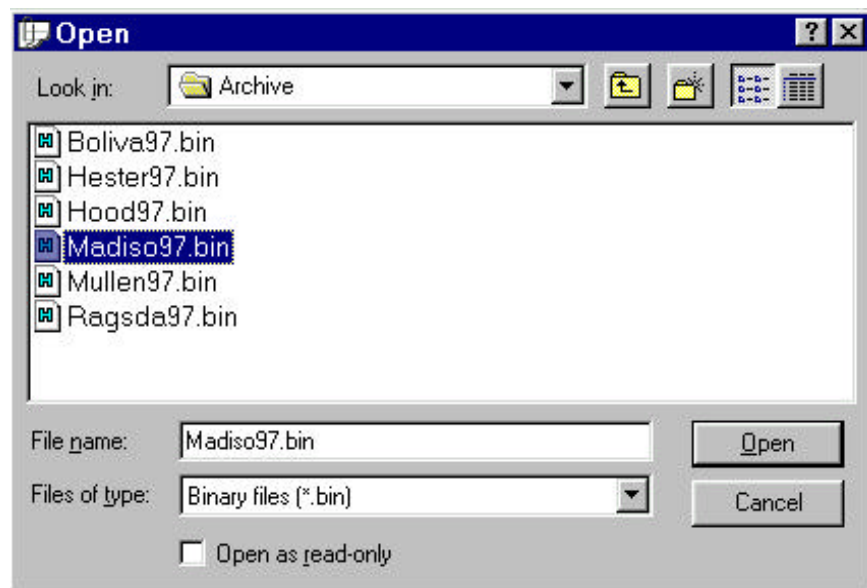


Press the ▾ button to see the list. Click the weather data category. In the GLYCIM example, it is the 'Actual Weather' category. Click 'OK' to proceed. You will see the data category window containing the list of available datasets and the control buttons 'New', 'Open', 'Copy', 'Delete', 'Import', 'Export', 'Quit', 'Refresh', and 'Patch'. The button 'Patch' is used to repair a weather dataset with data obtained from a weather station. Click the weather dataset that you want to repair. The days of the year in the current dataset, the date of the last day in the file, and gaps in the sequence of the day numbers will be displayed at the bottom of the window.

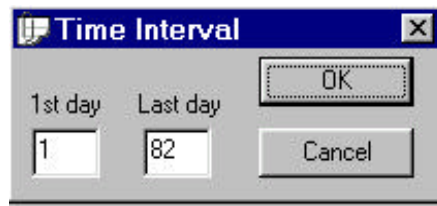
An example of the 'Actual Weather' category window with a dataset having gaps is shown below.



Click the 'Patch' button. The list of available raw weather data files will be shown in the 'Open' window. An example is shown below.



Click the raw weather data file that you want to use in patching the weather dataset. Click the 'Open' button. The 'Time Interval' window will be displayed that shows first and last days of the year for which data are available in the selected raw weather data file.



Type in the first and the last day of the gap in the dataset that you are patching and click 'OK'. You will be returned to the 'Actual Weather' window. The gap will disappear provided that the raw data file has data in the desirable interval of days. Repeat the operation if you have several gaps. Click 'Quit' when you have finished.

Chapter Six: *Adding A New Simulator To GUICS*

To make an existing crop simulator capable of working with GUICS, three operations are required. First, changes have to be made to the input and to the output of the program. Second, the structure of the input and output datasets has to be documented. Third, the code of the simulator has to be inserted into a standard code that will notify GUICS with an appropriate WINDOWS message when the simulation ends.

We assume that the simulator reads input files and produces output files. We do not accommodate simulators working with databases in this version of GUICS.

6.1. *Modifying And Documenting Input And Output*

The objectives of these operations are (a) to arrange for the input and output file names to be read from a single file 'RUN.DAT' and (b) to produce a 'PROFILE' file that will be used in GUICS to name and display your datasets properly.

Step-by-step instructions follow.

- 1.1. Number your input data files.
- 1.2. Assuming that each file represents a data category, give a short name to this category. For example, 'weather', 'FertAppl', or 'drainage' are suitable.
- 1.3. Give a descriptive name to each data category. For example, 'Daily weather' may be suitable for the 'weather' category, 'Fertilizer applications' may work for 'FertAppl', etc.
- 1.4. Assign to the input files of each category the same extensions, e.g., let the file that contains soil data get an extension like ".soi", etc.
- 1.5. Modify the output of the simulator to produce one or more of the following four files:
 - a 'graphics' file that will contain columns of daily calculated variables showing the crop status,
 - a 'summary' file that will be a relatively small text file containing condensed information about simulation results,
 - a 'report' file that may contain as much detailed output as needed for analysis of a particular simulation,
 - a 'table' file that will contain the most important numerical results of simulations, like yield, total irrigation, total rainfall, etc.

You may skip producing any of the four files if you do not want the corresponding output to be shown in GUICS.
- 1.6. Make your code read the input file names as character strings from the 'RUN.DAT' file in the same sequence as the input files were numbered.
- 1.7. Make your code read the input data in free format.
- 1.8. Create a file named 'PROFILE' describing your data sets and the presence or absence of each of the four output files.

Follow the format below.

Line #	Contains	Example
1	[Any descriptive title]	Profile for the canola model CAMOD
2	[Model's name - short]	CAMOD
3	[N = Number of data categories]	3
4	[1st data category short name]	Weather
5	[1st data category descriptive name]	Daily weather data
6	[1st data category extension]	.wea
7-9	[2nd data category]	
10-12	[3rd data category]	
...		
3*n+1	[Nth data category short name]	Phen
3*n+2	[Nth data category descriptive name]	Phenological parameters
3*n+3	[Nth data category extension]	.phn
3*n+4	['Graphics' file: 0 = absent, 1 = present]	1
3*n+5	['Summary' file: 0 = absent, 1 = present]	0
3*n+6	['Report' file: 0 = absent, 1 = present]	1
3*n+7	['Table' file: 0 = absent, 1 = present]	1

6.2 Documenting Input And Output Datasets

To list and describe all items that are in any of the new model's input and output files, you have to write scripts. Script files are written separately for each data category, and also for 'Graphics' and 'Table' files.

6.2.1 Writing Scripts For Data Categories

A script file for a data category must have a name coinciding with the short name of the data category (which are listed in lines 4, 7 and so on of the 'PROFILE' file).

Any script file name has to have the extension ".sct".

The script files for output should have names "GRAPHICS.SCT" and "TABLE.SCT".

The grammar of scripts follows.

Any entry in a dataset, numeric or not, is called an item. An item can be a number, a character, or a table, or a combo-box (drop-list).

Each 'table' item represents one or more one-dimensional arrays. Each array is placed in the table column. Several arrays of the same length can be placed in adjacent columns in a

table. For example, in weather files, data on daily radiation, temperature, and precipitation are placed in adjacent columns, one column for each type of data. A single array (column) will also be represented by a 'table' item.

Every item and each column in a table has a name and a display format. Display format is needed if you have a preference how the variable will be shown when editing datasets in GUICS. Otherwise, it can be omitted (see below).

Every script begins with a title as a first line. This line is skipped by interface but you need to provide it.

The end of a script file is marked with "@@".

The body of a script file between the first and the last lines consists of descriptions of each item. The description of every item has exactly 3 lines.

The first line of a description provides the item's number, e.g., "@12", where "12" is the item number itself and "@" marks the beginning of a description. Descriptions are numbered as @0, @1 and so forth. The interface checks these numbers and does not accept scripts with incorrect numbering.

The second line of an item description contains the name of the corresponding item (not longer than 50 characters).

The third line of a description shows the type and format of the item. Accepted types are:

int	Integer number
float	Floating point number
char	A portion of text, delimited with starting and ending apostrophes.
date	Of format MM/DD/YY - month, day and year each having two digits, e.g. 07/08/97.
date(short)	Of format 'MM/DD', with apostrophes.
dummy	To mark an item which currently is not used by the model or which you for some reason do not want to be available for editing. Such an item should appear in the data file as a separate line and may actually be a set of items on one line. Dummy items are reproduced by GUICS "as is" when a data set is edited. The user does not have any access to them.
combo	A Windows combo box. Must be supplied with a list of alternatives (see example below).
table	This description marks the beginning of a table of items. After this three-line description, descriptions of each column follow, beginning with the first column.

A type is followed with a format in parentheses. These parentheses may be empty (no format) but they are still required, e.g.

```
int()
int(%3d)
float(%7.1f)
float(%9.1E)
float(%.1G)
dummy()
date()
date(short)
char()
char(%s)
char(%10s)
combo(Sprinkle,Furrow,Flood)
table(1,&3)
table(<7,&12)
table(5,&-1)
```

The ‘dummy’ type does not require format (but parentheses are still required!).

The ‘int’ and ‘float’ type formats must obey the standard C-conventions. They begin with "%", followed with (optional) field length, then (in case of float) precision (again optional). If precision is present, it is preceded with a dot ".". Format is ended with "d" for integers, "f" for floats when desired in fixed format, "e" or "E" for floats to be presented in exponential format and "g" or "G" for mixed format.

A slash (/) is used as the last character in a format to indicate that the next item starts new line, i.e. "/" means a new line.

We repeat that it is not necessary to supply a format for the ‘int’, ‘float’, ‘date’, and ‘char’ types if the item is not the last one on a line. You may leave empty parentheses. In that case the item will be presented in some default format. A slash can be used alone in the format if the item is the last one on a line.

Tables must have a format that consists of two numbers separated by a comma. The first number equals the number of columns in the table. The second number is the number of the item in the script file that contains the number of rows in the table. For example, a soil data file may contain an item "number of horizons", followed by a table that lists several properties for each of these horizons. The script file describing this dataset might look like this:

```
.....
@15
number of horizons
int()
```

```

.....
@24
properties of each horizon
table(6,&15)
.....

```

The second number in the format for the table (15) is the script file number for the item "number of horizons". The item that specifies the number of rows must appear in the script before the table. Because this item may be changed when a dataset is edited, care must be taken to ensure that the new number of rows corresponds with the number of rows in the new table.

The first number in a table's format can be preceded with a "<". In that case, the number will be the upper limit for the number of columns, whereas in the current data file this table may have fewer columns. For a such a table, each row must occupy exactly one line in the datafile.

In the case of large tables, where the numbers of rows and columns are completely specified, it is not necessary for each row of data to be on a single line. Each row can extend over several lines and it will still be properly treated.

The second number in a table's format is always preceded with ampersand "&". This ampersand reserves space for future updates.

If the second number in the table format equals -1, this marks the case of a table which ends with the end of the data file. This table must be the last portion of information in the data file.

We present as an example of the script for the following GLYCIM soil file:

```

'BOSKET4.HYD 'Bosket sandy loam,DBES,F9,Stoneville,MS 1989
3
.64920E-04 .13200E+00 .45740E+02 .45900E+00 .38100E+00 .38000E-01 .12990E+01 3.57e+00 3.476e+00
.64920E-04 .13200E+00 .45740E+02 .45900E+00 .38100E+00 .38000E-01 .12990E+01 3.57e+00 3.476e+00
.46000E+02 .50500E+00 .00000E+00 .10000E+01 -.10000E+00 -0.01e+00 999 -2130509298
26 .64920E-04 .13200E+00 .45740E+02 .45900E+00
.38100E+00 .91800E-01 .12990E+01 3.57e+00 3.476e+00 -.532e-01
53 10 -2130509254
71 .12310E-02 .16500E+00 .38680E+02 .49500E+00
.29700E+00 .137e-08 .11910E+01 3.12e+00 5.293e+00 -.433e-03
56 10 -2130509210
201 .28340E-03 .14300E+00 .41840E+02 .50500E+00
.36200E+00 .10500E+00 .11620E+01 3.12e+00 5.293e+00 -.302e-01
75 5 0

```

The file begins with two character strings. Then, there is the number of horizons (3 in this case). The three following lines are inherited from previous versions and are kept to allow us to use old datasets. The table follows next. It contains 14 columns and three rows. The total number of the rows is the same as the number of soil horizons. The variables in the columns are maximum depth of soil horizon, cm, hydraulic diffusivity at -15 bars (m^2/day), volumetric water content at -15 bars, slope of log (hydraulic diffusivity) vs. volumetric water content, saturated water content, volumetric water content at field capacity,

volumetric water content of air dry soil, bulk density (g/cm^3), water content / water potential parameter, saturated hydraulic conductivity (cm/day), water potential of air entry (bar), sand content (%), clay content (%), and an integer pointer (not used).

The script file for this soil dataset is:

```
Script for Soil Data file for Glycim
@0
Database name
char(%s/)
@1
Soil name and location
char(%s/)
@2
Number of soil horizons
int(%3d/)
@3
Unused
dummy()
@4
Unused
dummy()
@5
Unused
dummy()
@6
Table of soil properties
table(14,&2)
@7
Maximum depth of soil horizon, cm
float(%4.0f)
@8
Hydraulic diffusivity at -15 bars,  $\text{cm}^2/\text{day}$ 
float(%11.4E)
@9
Volum. water content at -15 bars
float(%7.4f)
@10
Slope of log(hydr cond) vs. volum. water content
float(%7.4f)
@11
Saturated water content
float(%7.4f)
@12
Volum. water content at FC
float(%4f)
@13
Volum. water content of air dry soil
float(%10.4f)
@14
Bulk density,  $\text{g/cm}^3$ 
float(%8.2f)
@15
Water content / water potential parameter
float(%10.2E)
@16
Saturated hydraulic conductivity,  $\text{cm/day}$ 
```

```

float(%11.3E)
@17
Water potential of air entry, bars
float(%12.4E)
@18
Sand content, %
float(%5.1f)
@19
Clay content, %
float(%5.1f)
@20
Trash
dummy(/)
@@

```

6.2.2 Writing Scripts For ‘Graphics’ Files

The graphics file consists of a single table. The script of a graphics file assumes that the first column is day of year. All other columns are listed as numbered items according to the script grammar in section 6.2.1.

We present as an example, the script for the following GLYCIM graphics file:

183	0.025	58.240	58.265	9.826	2	0	.000	-.304	6.549
184	0.259	62.342	62.601	10.492	3	0	.000	-.280	6.848
185	0.486	64.958	65.444	11.152	3	0	.000	-.256	7.139
186	0.734	69.601	70.335	11.887	3	0	.000	-.231	7.455
187	1.735	74.535	76.270	12.657	3	0	.000	-.207	7.780
188	2.782	65.474	68.256	13.388	3	0	.000	-.183	8.082
189	3.974	70.641	74.615	14.200	3	0	.000	-.158	8.411
.										

The script file for this graphics file is:

```

Script for graphics (Glycim)
@0
Leaf area on the branches, sq. in.
float()
@1
Leaf area on the main stem, sq. in.
float()
@2
Leaf area total, sq. in.
float()
@3
Main stem height, in.
float()
@4

```

```

Number of branches
float()
@5
Number of flowers
float()
@6
Number of pods
float()
@7
Reproductive stage
float()
@8
Vegetative stage
float()
. . . . .
. . . . .

Leaf water stress
float()
@@

```

6.2.3 Writing Scripts For ‘Table’ Files

It is assumed that this file always has a single line of numbers. The script (table.sct) describes this line according to the grammar of section 6.2.1.

For the GLYCIM example, the script of the ‘table’ file is:

```

@0
Yield, lb/ac
float(%7.1f)
@1
Maturity date
date(short)
@2
Crop cover %
float(%9.1f)
@3
Rainfall, in
float(%9.1f)
@4
Irrigation, in
float(%9.1f)
@5
Potential transpiration, in
float(%9.1f)
@6
Actual transpiration, in
float(%9.1f)
@7
Drainage, in
float(%9.1f)
@@

```

We recommend in any questionable case to confer to sample scripts supplied with the model GLYCIM.

6.3. Bracketing the Crop Simulator

We assume that the model to be plugged into GUICS is coded in C or FORTRAN dialects, compatible with Windows 95. We have used Microsoft C/C++ and Microsoft FORTRAN 90.

A program, written in dialects of FORTRAN 77 may need some modifications to be recompiled with FORTRAN 90. Please, refer to the corresponding software manuals.

A FORTRAN program must be transformed to become a subroutine without parameters.

A new WinMain program is supplied that:

- (i) provides interface with Windows,
- (ii) starts the aforementioned subroutine,
- (iii) sends final message to GUICS and returns.

The text of the WinMain is given in Appendix B.


A program, written in C to run under Windows, is only updated to include the final message. The text of this message is given in Appendix B.

A program, written in C to run under DOS, needs changes analogous to the FORTRAN case.

6.4. Installing the Crop Simulator

Collect the script file, modified executable files, and the 'PROFILE' file into one folder. Click the 'Model' item on the menu bar. Click 'Add'. The Windows 'Open' dialog box will be displayed. Find the folder where the 'PROFILE' and other files are, click the name of the 'PROFILE' file, and click 'Open'.

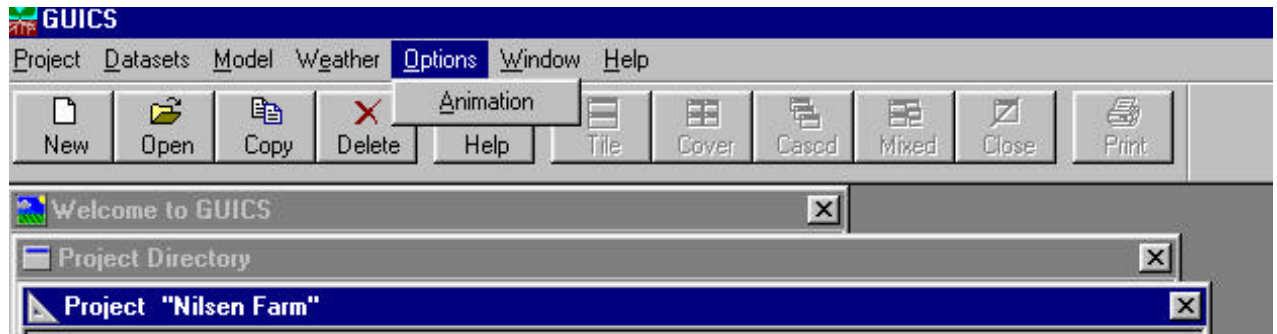
6.5. Removing a Crop Simulator

Click the 'Model' item on the menu bar. Click 'Remove'. The 'Select Model to Remove' window will be displayed. The combo box contains the list of models plugged in your version of GUICS. Press the  button to see the list. Click the name of the model you want to remove.

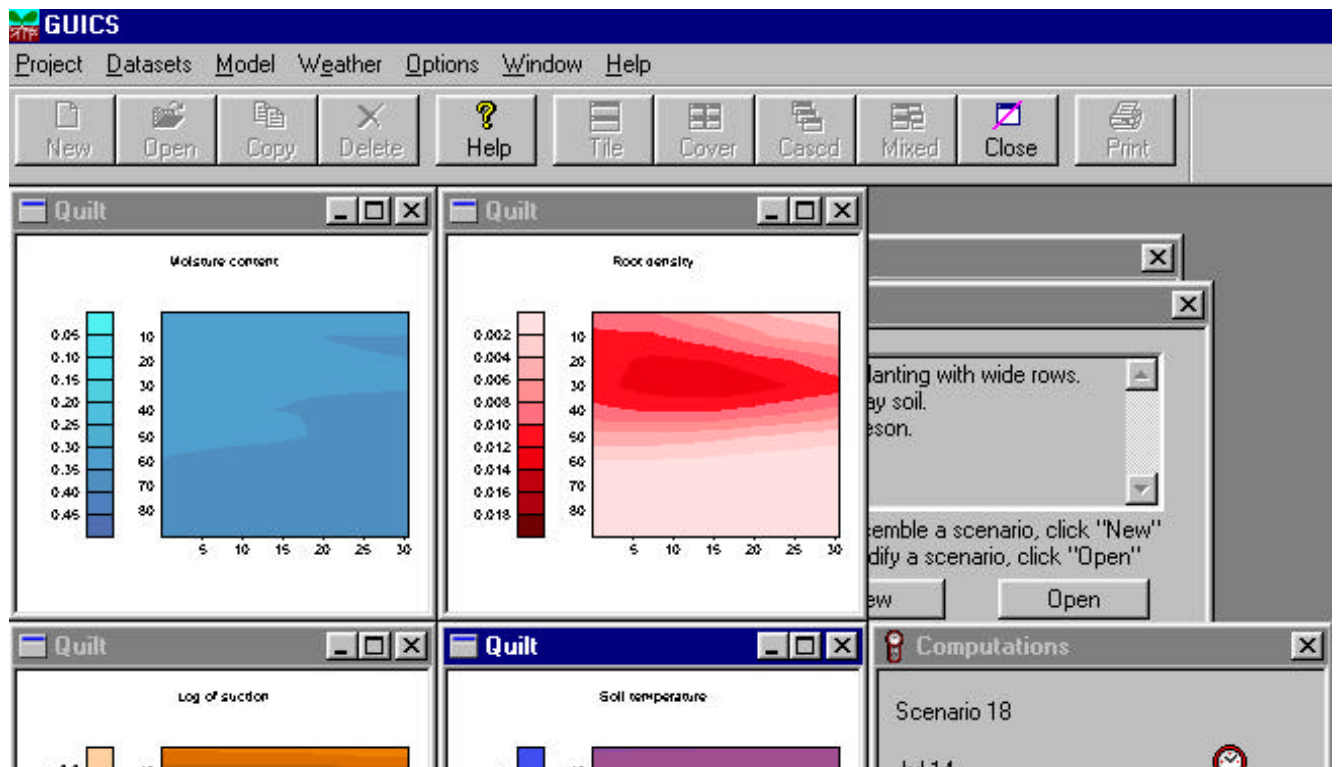
Chapter Seven: Viewing Model-specific Graphics

Some crop simulators may have specific graphical capabilities to display data and results. GUICS provides an optional use of these capabilities.

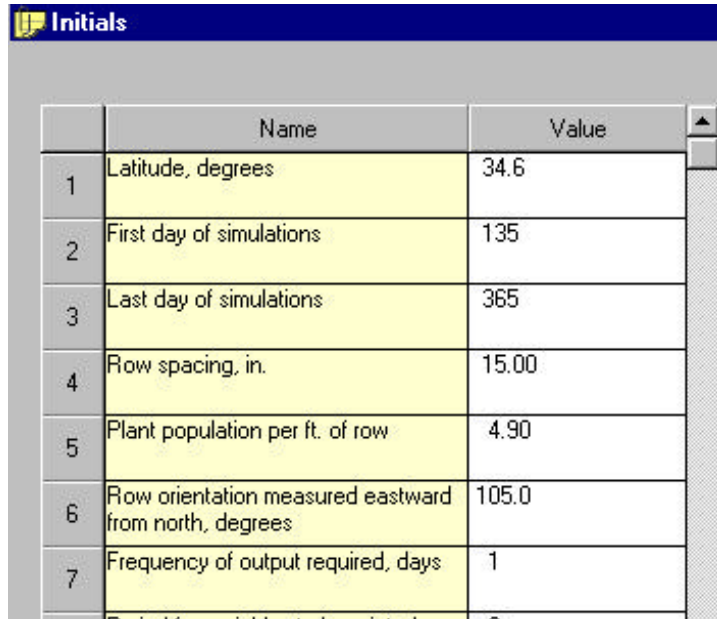
To view available graphical options, select one or more scenarios in the current project window and click 'Options' button at the GUICS menu bar. The list of available options will be displayed. The 'Animation' option will be displayed in the GLYCIM example.



To use an option, checkmark it by clicking at it. Then click the 'View results' button in the project window. Distributions of soil water potential, soil water content, temperature and root density in soil profile will be shown as the GLYCIM model runs.



You need to refer to the model's manual to control graphical options specific for a model. In the GLYCIM simulator, for example, it is possible to control the number of days between consecutive graphs. This number is entered in data sets of the 'Initialization' data category as the 'Frequency of output required, days'.








	Name	Value
1	Latitude, degrees	34.6
2	First day of simulations	135
3	Last day of simulations	365
4	Row spacing, in.	15.00
5	Plant population per ft. of row	4.90
6	Row orientation measured eastward from north, degrees	105.0
7	Frequency of output required, days	1

To close the model-specific graphs, press the close toolbar button

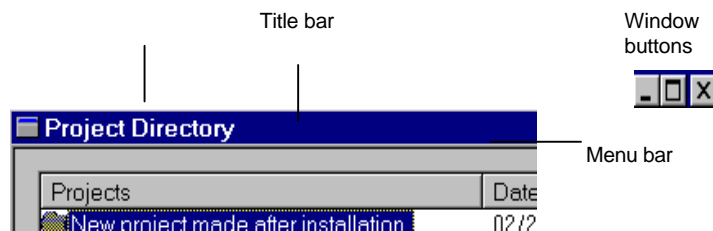


Chapter Eight: *Removing GUICS from Your Computer*

1. Click Start button  on your taskbar.
2. Go to the Settings program group .
3. Go to the Control Panel program group  and click it.
4. Doubleclick the 'Add/Remove Program' icon .
5. Click GUICS in the list of programs and click the 'Add/Remove...' button.
6. Click 'Yes' in the 'Confirm File Deletion' window.
7. UninstallShield program will remove components of GUICS from your computer.
Click the 'Yes' button if you will be asked whether any of dynamic link library files ('mfc42.dll', 'msvcirt.dll', 'msvcrt.dll', 'ug30.dll', or 'tapi32.dll') should be deleted.
8. Click 'OK' when the UninstallShield program completes its work and informs you that some files should be deleted manually.
9. Click 'OK' in the 'Add/Remove Programs Properties' window.
10. Doubleclick the 'My Computer' icon .
11. Find the icon of the destination directory that was used in installation of GUICS (GUICS by default). Click this icon and press 'Delete' key on the keyboard. Confirm deletion if you will be prompted to.

APPENDIX A *Terminology*

We follow the terminology and conventions proposed in Windows Interface Guidelines (1995). Common components of primary windows are referred as shown below.



We refer to windows using their title text.

The items in pop-up menus are referred to as Name1|Name2 where Name1 is the menu title and Name2 is the menu item. One letter is underscored in each of these names. Pressing the underscored letter in the menu name along with the 'Alt' key opens the menu. Pressing the underscored letter in the menu item name starts the operation associated with this item.

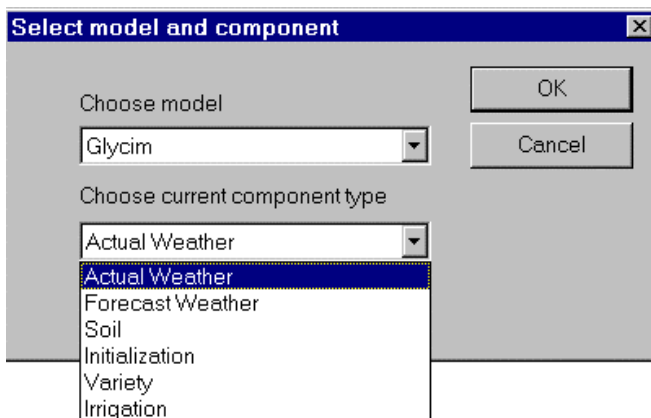
The tool bar is placed under the menu bar. It consists of several command buttons that can be used only from the active window. Tooltips, i.e. small pop-up windows show the primary functions of buttons in the toolbar.



List boxes are used to display and to select projects, scenarios and datasets.

Scenarios	Date	Status
Bosket field in 94	10/06/96	Computed
Abernathy field in 95	10/06/96	Computed
Abernathy field in 94	10/06/96	Computed
Bosket field in 95	10/06/96	Computed
Bosket field in 94 [var # 1]	10/06/96	Computed
Bosket field in 94 [var # 2]	10/06/96	Computed

Combo boxes are used to select a model or a data category.



Multiple selection list boxes are used to select results to be displayed in graphic or in tabular form.

Select

- ☐ Leaf area on the branches, sq. in.
- ☐ Leaf area on the main stem, sq. in."
- ☐ Leaf area total, sq. in."
- ☐ Main stem height, in.
- ☐ Number of branches
- ☐ Number of flowers
- ☐ Number of pods
- ☐ Reproductive stage
- ☐ Vegetative stage
- ☐ Number of seeds
- ☐ Seed weight, oz. per plant
- ☐ Maximum temperature, °F
- ☐ Minimum temperature, °F
- ☐ Precipitation, in.
- ☐ Solar radiation, Langley (cal/cm²)

OK

Cancel

APPENDIX B *Standard Code*

B.1. Executable file – FORTRAN

We assume that the main program of the model's code is now a subroutine without parameters called **ModelMain**.

Compilation of the following code will produce an executable file that has to be used when the model is added to GUICS.

```
! FORTRAN 90 text
  integer function WinMain (hInstance, hPrevInstance,      &
                           lpszCmdLine, nCmdShow)
  !MS$ ATTRIBUTES STDCALL, ALIAS : '_WinMain@16' :: WinMain

      USE MSFWIN
      INTEGER, intent(IN) :: hInstance, hPrevInstance
      INTEGER, intent(IN) :: nCmdShow
      INTEGER, intent(IN) :: lpszCmdLine

      INTEGER retval, yield
      LOGICAL retlog

      hWndMain = FindWindow (NULL, "GUICS"C)
      IF (hWndMain .EQ. 0) THEN
          retval = MessageBox (NULL, "Interface is needed!"C,      &
                              'Error'C, IOR(MB_OK,MB_ICONSTOP))
          WinMain = -1
          RETURN
      END IF
      CALL ModelMain

      retlog = PostMessage(hWndMain, 1028, INFO1, INFO2)

! 1028 is a code for END-OF-WORK message.
! INFO1 and INFO2 may be some data to hand to interface.

      WinMain = 0
      END
!-----
      SUBROUTINE ModelMain      ! Former main, now subroutine
!-----
      <Text of former FORTRAN main program>
      <Text of all subroutines>
```

B.2. Executable file – C++

A C++ program written to run under Windows has to be amended at the point of return at least with the following two lines:

```

HWND hWndMain = FindWindow (NULL, "GUICS");
PostMessage(hWndMain, 1028, (WPARAM)INFO1, (LPARAM)INFO2);

```

The main program of a C code written to work under DOS has to be transformed into void function ModelMain (). The following code has to be compiled to obtain the executable to use when the model is added to GUICS.

```

#include <windows.h> // includes basic windows functionality
#include <stdio.h>
#include <string.h>

HINSTANCE hInst;

/*****
*
*   FUNCTION: WinMain(HANDLE, HANDLE, LPSTR, int)
*
*****/

int APIENTRY WinMain(
    HINSTANCE hInstance,
    HINSTANCE hPrevInstance,
    LPSTR lpCmdLine,
    int nCmdShow
)
{
    HWND hWndMain = FindWindow (NULL, " - GUICS");

    ModelMain();

    PostMessage(hWndMain, 1028, (WPARAM)INFO1, (LPARAM)INFO2);
    return 0;
}

```

B.3. *Dynamic Link Library*

To use model-specific graphics under GUICS, both the executable code of the model and the auxiliary routines need to be compiled as dynamic link libraries (DLL). We present here an example of GLYCIM that illustrates general idea and can be used as a template for other models.

Two DLLs are used. The Glycim.dll exports the function Model that contains the model itself, allocates a memory for data exchange and updates those data during a scenario run.

The QuiltAux.dll exports function GetDim that defines all the model-specific parameters and adapts data pointers for GUICS.

The function Model is arranged as follows:

```

INTEGER(4) FUNCTION MODEL(ThreadParm)
    !MS$ATTRIBUTES DLLEXPORT :: MODEL

    USE MSFWIN

```

```

.....
INTEGER(4) ThreadParm(6), DayFromDate, ERRCLS, Weather, iret
CHARACTER SoilFile*130, InitialsFile*130, CultivarFile*130,      &
          IrrigationFile*130, GraphFile*130, ReportFile*130,    &
          SummaryFile*130, TableFile*130, String*80,            &
          TaskFile*130
POINTER (Pntr, TaskFile)
.....

```

```

hWndMain = ThreadParm(1)                ! a handle to the main window
ThreadParm(3) = GlobalAlloc(0, 804*8)    ! 4 int, 2 + 4*200 double
ThreadParm(4) = GlobalLock(ThreadParm(3))
iAttrPtr  = ThreadParm(4)
fAttrPtr  = iAttrPtr + 16
BuffPtr   = fAttrPtr + 16
hMutex    = ThreadParm(5)                ! mutex defined in GUICS
Pntr      = ThreadParm(6)                ! lpszTaskFile
.....

```

```

iret = WaitForSingleObject( hMutex, INFINITE )
iAttr(1) = NKH
iAttr(2) = NL
iAttr(3) = 10
iAttr(4) = 20
fAttr(1) = WIDTH
fAttr(2) = DEPTH
iret = ReleaseMutex( hMutex )
iret = PostMessage (hWndMain, 1032, 0, 0) ! sends a message the ! dimensions are
                                           ! ready
.....

```

! periodically updates the data

```

iret = WaitForSingleObject( hMutex, INFINITE )

DO K = 1, NKH
  DO L = 1, NL
    Buffer(K,L,1) = VH2OC(L,K)
    Buffer(K,L,2) = RTWT(L,K)
    Buffer(K,L,3) = ALOG10(ABS(PSIS(L,K)))
    Buffer(K,L,4) = TS(L,K)
  END DO
END DO
iret = ReleaseMutex( hMutex )
iret = PostMessage ( hWndMain, 1032, JDAY, 0 ) ! data are ready
.....

```

Note that the final message (=1028) **must not** be sent now.
 As the model is a thread (and no longer an independent program), it must receive all necessary information through the argument ThreadParm passed from GUICS.

ThreadParm[0] : handle to the main GUICS' window
 ThreadParm[1] : (not used by MODEL)
 ThreadParm[2] : HGLOBAL hMem (memory, allocated in MODEL)
 ThreadParm[3] : pointer to the data buffer (produced in MODEL)
 ThreadParm[4] : handle to the mutex (defined in GUICS)
 ThreadParm[5] : a pointer to the character string = a path to the task file that lists all the input files
 ThreadParm[6] : (not used by MODEL)

A sample listing of the function GetDim follows.

```
// For use with Glycim
#include "stdafx.h"
extern "C" __declspec(dllexport)
int GetDim (DWORD DW, int* pM, int* pN, int* pMmax, int* pNmax,
            CString* Title, double** f, double** px, double** py,
            double** pDx, double** pDy, double* fmin, double* fmax)
{
  // Arguments:
  // DW – produced in Glycim.dll - contains a pointer to allocated memory (input)
  // *pM and *pN – actual grid width and height (output)
  // *pMmax and *pNmax - maximum dimensions (in the case of GLYCIM they are not equal
  // to the actual sizes of the grid
  // Title – a CString array providing titles to all clips
  // *f[] – pointers to data
  // *px and *py – pointers to grid coordinates (these are produced by GetDim)
  // *pDx and *pDy – pointers to coordinates increments (they will be calculated later by GUICS)
  // fmin[] and fmax[] - bounds for the variables to be graphed

  AFX_MANAGE_STATE(AfxGetStaticModuleState())
  int i, j, nScr;

  // Number of pictures
  nScr = 4;

  // Bounds for variables
  fmin[0] = 0.0; // VH2OC
  fmax[0] = 0.5;
  fmin[1] = 0.0; // RTWT
  fmax[1] = 0.02;
  fmin[2] = -1.0; // PSIS
  fmax[2] = 1.4;
  fmin[3] = 0.0; // TS
  fmax[3] = 40.0;

  int* iPtr = (int*)DW;
  double* fPtr = (double*)DW;

  // Actual grid dimensions
  *pM = *iPtr;
  *pN = *(iPtr + 1);

  // Maximum dimensions
  *pMmax = *(iPtr + 2);
  *pNmax = *(iPtr + 3);
}
```

```

// Cell sizes
double Width= *(fPtr + 2);
double Depth= *(fPtr + 3);

// Array size
int Size = (*pNmax)*(*pMmax);

// Pointers to arrays
f[0] = fPtr + 4;
for (i=1; i<nScr; i++)
    f[i] = f[i-1] + Size;

// Coordinates
*pDx = (double*)calloc(2*(*pN+*pM+2), sizeof(double));
*pDy = (double*)&(*pDx)[*pM+1];
*px = (double*)&(*pDy)[*pN+1];
*py = (double*)&(*px)[*pM+1];

for (i=0; i<= *pM; i++)
    (*px)[i] = i*Width;

for (j=0; j<= *pN; j++)
    (*py)[j] = j*Depth;

Title[0] = "Moisture content";
Title[1] = "Root density";
Title[2] = "Log of suction";
Title[3] = "Soil temperature";
return nScr;
}

```

APPENDIX C

File System of GUICS

C.1. Directories and Permanent Files

GUICS	GUICS home directory
■ guics.exe	GUICS executable
■ convert.exe	Conversion program
■ guics.hlp	Help file
■ guics.cnt	Contents file
■ station.dat	Weather station database
■ ARCHIVE	Weather binary download archive
■ <MODEL1>	Directory for the 1 st model
■ <model1>.exe	1 st model's executable
■ profile	Definition of the model
■ graph.sct	Script for the model's graphic output
■ table.sct	Script for the model's table output
■ <u><COMPONENT1></u>	Directory with datasets of the 1 st category
■ <u><COMPONENT2></u>	Directory with datasets of the 2 nd category
■	
■ <MODEL2>	Directory for the 2 nd model
■ <model2>.exe	2 nd model's executable
■ profile	
■ graph.sct	
■ table.sct	
■ <COMPONENT1>	
■ <COMPONENT2>	
■	
■	
■ PROJECTS	
■ <u><PROJECT1>.PRT</u>	
■ <u><PROJECT2>.PRT</u>	
■	

C.2. Dataset Files

All of the datasets belonging to a particular component of the model reside in the directory <COMPONENT_NAME>. For example, in the GLYCIM model, the first component of the model is weather; therefore, the corresponding datasets would be in the WEATHER directory.

For each dataset, there are three files:

<dataset>.hdr, which contains the logical name of the dataset and its memo;
<dataset>.<ext> which contains the dataset data; the file name extension is defined in each model's profile;
<dataset>.ico which contains this dataset's icon.

The dataset belonging to a component regarded as modem component (this can only be a weather component) may also have a file with name **<dataset>.bnd**. This file is used to control the contiguity of the weather data.

Dataset names that appear on the screen are not necessarily the names that will be used for the original dataset files. Datasets that contain the same types of data will share the same **<component_name>.def** and **<component_name>.sct** files.

C.3. Project Files

Every project has a directory with name **<PROJECT_FILE_NAME>.PRT**. This directory contains the project's header file, **descript.hdr** and project's icon file, **icon.ico**. **Descript.hdr** contains the project's logical name and memo. Also, in this directory are each project's scenario files. All project directories are subdirectories of the directory **PROJECTS**. The logical name of a project does not necessarily coincides with the corresponding physical name of this project's directory.

C.4. Scenario Files

All scenarios of any project live in this project's directory **<PROJECT_FILE_NAME>.PRT**. An assembled scenario **<Scenario_name>** has three files:

1. **<Scenario_Name>.scn**, which contains the scenario's logical name and memo.
2. **<Scenario_Name>.ico**, which contains the scenario's icon.
3. **<Scenario_Name>.run**, which contains the name of the scenario's model and a list of its datasets.

After a scenario is computed, the model may produce these additional files.

4. **<Scenario_Name>.out**,
5. **<Scenario_Name>.grp** (or **<Scenario_Name>.g01>**),
6. **<Scenario_Name>.tab**
7. **<Scenario_Name>.sum**

C.5. Weather Binary Files

Current weather binary files reside in a directory **\GUICS\ARCHIVE**. Their internal format is binary. It is reported here only for the sake of completeness.

No.	Variable	Internal type	Length, bytes	Comments

1	Name	char	32	Name of the station
2	Phone	char	24	Phone number
3	Sign	WORD[2]	4	Current status of the station
4	Pointer	LONG	4	Last datalogger pointer value
5	FirstDay	WORD	2	Julian number of the first day available in this file
6	LastDay	WORD	2	Julian number of the last day available in this file
7	LSeq	WORD[3]	6	Lengths of 15-min, 1-hour and 1-day records, respectively
8	uTime		8	Reflects the last time when downloaded
9	reserved	WORD	2	
10	reserved	WORD[14]	28	

After this header the file contains weather records as they result from download.

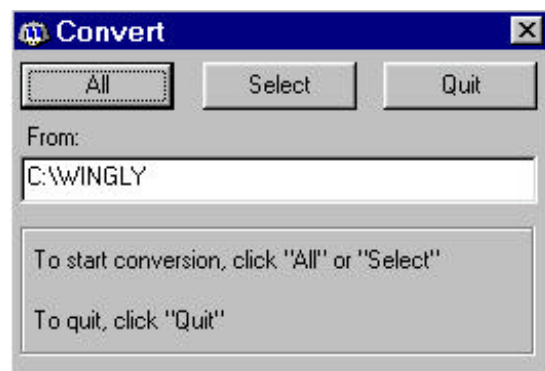
APPENDIX D *Converting WINGLY Files to GUICS Format*

The old WINGLY-style files (jobs / runs) can be (optionally) converted into GUICS files (project / scenarios / datasets).

- The conversion is valid only for the GLYCIM model.
- The old files remain unchanged.
- Every job transforms into a project with the same name.
- Every run belonging to the job transforms into a scenario with the name of the job plus a number in square brackets, e.g. "job1[05]".
- Newly created scenarios will have "Assembled" status.
- Datasets belonging to new scenarios will be copied to an appropriate dataset directory. If there were files with coinciding names, they will be overwritten!

Normally you will be prompted to perform converting (and may skip it) at the end of the installation procedure. However the conversion program **convert.exe** resides in the same directory as **guics.exe** (see [Directories and Permanent Files](#)) and can be invoked at any time.

Working with **convert.exe** is simple and straightforward.



You have two possibilities :

- either click **All** to convert all of the old files,
- or click **Select** - you will evoke the standard Windows-style file dialog. Go to the directory you need and select jobs which are to be converted, then click the button **Open** in the file dialog.

First choice requires that the full path of the old files (e.g. “c:\wingly”) is to be supplied for the converter. If the path appears to be invalid, you will get a message that the file “variety.dat” is lacking and the procedure stops.

Second choice does not require this information since you can manage paths with the file dialog.

In both cases, if during the conversion procedure some files appear to be missing, you will get a message that the conversion may be incomplete (and the corresponding scenario will lack some datasets). This could be managed through editing the affected scenarios.

